



*The Trusted Integrator for Sustainable Solutions*

**Weston Solutions, Inc.**  
Suite 201  
1090 King Georges Post Road  
Edison, New Jersey 08837-3703  
732-585-4400 • Fax: 732-225-7037  
www.westonsolutions.com

REMOVAL SUPPORT TEAM 3  
EPA CONTRACT EP-S2-14-01

July 24, 2015

Mr. David Rosoff, On-Scene Coordinator  
U.S. Environmental Protection Agency, Region II  
Removal Action Branch  
2890 Woodbridge Avenue  
Edison, NJ 08837

**EPA CONTRACT No.: EP-S2-14-01**

**TDD No.: TO-0006-0056**

**DOCUMENT CONTROL No.: RST3-02-D-0017**

**SUBJECT: SITE-SPECIFIC SAMPLING PLAN – LAKE ERIE SMELTING SITE -  
BUFFALO, ERIE COUNTY, NEW YORK**

Dear Mr. Rosoff,

Enclosed please find the Site-Specific Sampling Plan for the Removal Assessment soil sampling and X-Ray Fluorescence (XRF) screening activities to be conducted at the Lake Erie Smelting Site located in Buffalo, Erie County, New York beginning on August 3, 2015. If you have any questions or comments, please do not hesitate to contact me at (603) 512-4350.

Sincerely,  
Weston Solutions, Inc.

Peter Lisichenko  
RST 3 Site Project Manager/Group Leader

Enclosure

cc: TDD File No.: TO-0006-0056

**SITE-SPECIFIC SAMPLING PLAN**  
**LAKE ERIE SMELTER SITE**  
Buffalo, Erie County, New York

Prepared by:  
Removal Support Team 3  
Weston Solutions, Inc.  
Engineering, Science and Technology Division  
Edison, New Jersey 08837

DC No.: RST3-02-D-0017  
TDD No. TO-0006-0056  
EPA Contract No.: EP-S2-14-01

July 2015

## SITE HISTORY

The Lake Erie Smelting Corporation (LES) is the location of a former secondary lead smelter that occupied approximately 13,000 square feet (ft<sup>2</sup>) at the historical address of 29 Superior Street, Buffalo, Erie County, New York. The footprint of the former facility currently lies north of Clinton Street and west of Jefferson Street within the Towne Gardens apartment complex and is now occupied by two of the Towne Gardens' apartment units (see Attachment A: Figure 1).

The LES facility appears to have been a secondary smelter from approximately 1935 to the mid-1960s. The property was included in a list of hundreds of locations nationwide where secondary lead smelting or alloying might have been conducted between 1931 and 1964. The list was originally compiled by William P. Eckel in a doctoral dissertation for George Mason University and was based on entries in historical trade publications.

Secondary lead smelting is the recovery of lead metal and alloys from scrap, including lead-acid batteries, lead cable coverings, plumbing, type metal, and wheel weights. The chief alloy recovered for many years by secondary smelters was antimonial lead. Besides scrapped batteries, sources of scrap included drosses (by-products of lead refining), battery plant scrap, old pipes or roof flashing, cable sheathing, solder, and Babbitt metal, which are a group of lead-tin-antimony alloys used as antifriction metals in wheel bearings. Near many stationary sources, such as smelters, lead concentrations in soil may reach very high percentage levels and may persist in the surface soils (*i.e.*, 0.8 to 2 inches). Lead in soil and dust is a primary source of environmental lead exposure. LES, which operated as a secondary smelter, may have been responsible for releasing large amounts of lead contamination into the surrounding environment for a time period of approximately 30 years, from the mid-1930s to the mid-1960s. The facility also produced and consumed lead-tin-antimony alloys (*i.e.*, Babbitt metal); therefore, there was a potential for tin and antimony to be contained in any historical releases from the facility.

Towne Gardens is a residential apartment complex consisting of 360 total units. The housing units are surrounded by grass-covered lawns, concrete sidewalks, and asphalt-paved parking lots. The former LES facility footprint lies in the northeastern portion of the complex near Jefferson Avenue. Two of the residential apartment buildings and adjacent grass-covered areas occupy a portion of the footprint, as well as an attached single story building that appears to be an office. To the north of the footprint is one of the complex's parking lots and a commercial property. A residential area is located east and northeast of the Site.

According to available wind rose plots, the prevailing wind direction in Buffalo is approximately southwest to northeast, indicating that a residential neighborhood is downwind of the former smelter location. Site topography is flat; runoff from the Site is likely intercepted by storm drains located within the parking lot located immediately north of the former LES facility footprint.

In October 2014, soil samples were collected by the U.S. Environmental Protection Agency's (EPA) Site Assessment Team (SAT) contractor. These samples were collected from off-site locations from the Towne Garden complex at both upwind (background) and downwind directions based on the wind rose plots. Collected at various intervals down to 24 inches below ground surface (bgs), samples were analyzed for EPA target analyte list (TAL) metals, including tin. Results from these samples indicate a greater than three-fold increase in concentrations

between the upwind (background) and downwind samples. Furthermore, there were corresponding increases in antimony as well as tin results between the upwind and downwind samples, supporting a correlation to operations at LES.

## **SAMPLING METHODOLOGY**

A sampling grid pattern will be established throughout the Site with a decreasing frequency moving away from the footprint of the former smelter. Within and adjacent to the former smelter, the sampling grid will be 50 linear feet. Stepping 100 feet latterly to the West and South, the sampling grid will expand to 100 linear feet and the remainder of the Site grid spacing will be 200 linear feet. Due to the presence of impervious surfaces (*i.e.*, sidewalks, buildings, driveways, and parking lots) the actual placement of the sampling locations will be either eliminated or latterly offset resulting in irregular patterns.

Prior to field mobilization, utility damage prevention initiatives will be enacted. Tasks include filling notification with Dig Safely New York 811 service and reviewing available Site drawings. In addition, field teams will scan sample locations with a magnetometer prior to subsurface activities.

In accordance with EPA Environmental Response Team (ERT) Standard Operating Procedure (SOP) #2012<sup>1</sup>, discrete samples will be collected from each location from the following depth intervals: 0 to 1, 1 to 6, 6 to 12, 12 to 18, and 18 to 24 inches bgs. For the 0 to 1 and 1 to 6 interval, a “plug” of sod and soil will be extracted using a spade shovel. Approximately 8 ounces of material for each interval will be collected from this “plug” using dedicated plastic scoops, placed in separate 6 x 9 polyethylene bags and labeled accordingly. For the lower depth intervals, stainless steel hand augers will be used to advance down to depth for a particular depth interval. The cores will be emptied from the barrel of the auger into 10 x 12 polyethylene bag for homogenization. Once homogenized, 8 ounces of material will be extracted using dedicated plastic scoops, placed in a 6 x 9 polyethylene bag, and labeled accordingly. Fresh nitrile gloves will be donned for each sample collected. In accordance to SOP #2006<sup>2</sup>, all non-dedicated sampling equipment (*i.e.*, hand augers) will be cleaned and washed using proper decontamination methods, including an industrial soap solution and clean water. To ensure effective decontamination of non-dedicated sampling equipment, an aqueous rinsate blank will be collected at the end of each day from a non-dedicated sampling tool used that day and submitted for TAL metals, including tin, analysis.

All soil samples collected will be screened on-site using X-ray Fluorescence (XRF) technology. Prior to analysis, samples will be dried in on-site ovens to reduce moisture content of the samples. Analysis runs will be conducted over three 60-second intervals and averaged for a final result. Results for lead screening will be recorded for each sample and entered into EPA’s SCRIBE data management system. Calibration checks will be conducted daily against calibration blanks supplied by the manufacture and documented. Up to 30 percent (%) confirmation sampling will be conducted whereby 30 % of the samples collected will be submitted to an EPA-procured laboratory for TAL metals, including tin, analysis. Selection of

---

<sup>1</sup> EPA ERT SOP# 2012: Soil Sampling

<sup>2</sup> EPA ERT SOP# 2006: Sampling Equipment Decontamination

these samples will be as directed by the EPA On-scene Coordinator (OSC). Samples for laboratory analysis will be transferred to 8 ounce glass jars and all sampling information will be entered in EPA SCRIBE data management system. Quality control samples will be collected at a rate 1 per 20 samples. The analytical results will be compared to the field screening results and a correlation factor will be determined to evaluate the accuracy of the XRF analyzer.

All soil borings will be backfilled daily and locations will be restored to pre-sampling conditions as reasonably possible. Top soil and a mix grass seed blend may be used as needed for restoration purposes.

Based on the approach described above, the following quantities have been estimated for this assessment:

Total number of locations for sampling: 52

Total number of samples to be collected for field screening: 260

Total number of confirmation samples for laboratory analysis (including QA/QC): 82

Anticipated number of rinsate blanks (one per day of sampling): 4

The proposed sample locations are included in Attachment A: Figure 2.

The Site Specific Quality Assurance Project Plan (QAPP) and Health and Safety Plan (HASP) are included in Attachment B.

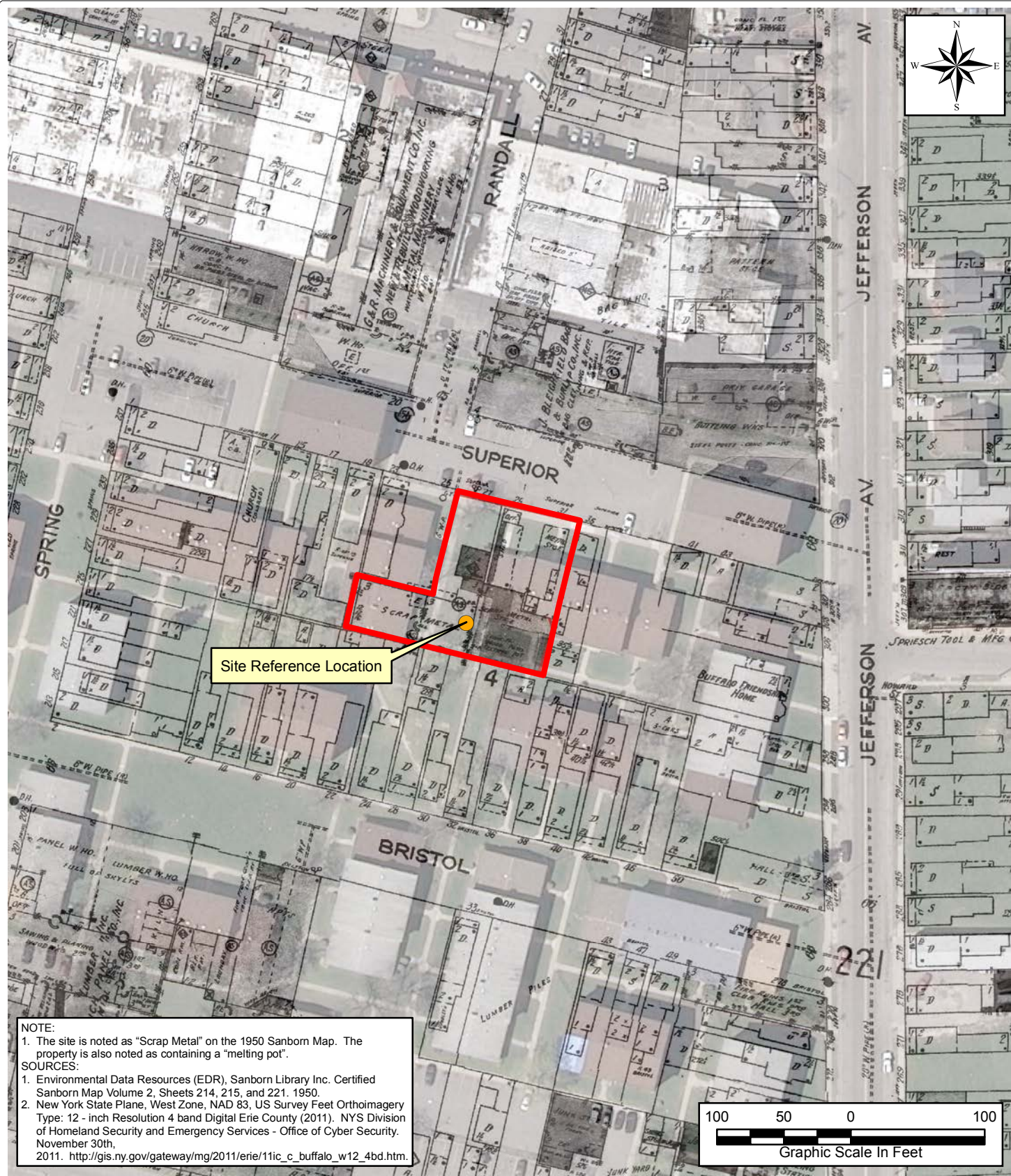
## **POTENTIAL FOLLOW-UP ACTIONS**

Based on results from the above described assessment, a follow-up risk based assessment may be required for both on-site (Towne Garden complex) and the surrounding residential neighborhood. Following EPA's Superfund Lead-Contaminated Residential Sites Handbook (August 2003), the Towne Garden complex would be divided into quarter-acre quadrants and 5-point composite samples would be collected from each quadrant for XRF screening and confirmation laboratory analysis. Residential parcels would be divided into quadrants based on property configuration and sampled for XRF screening and confirmation laboratory analysis.

**ATTACHMENT A:**

**FIGURES**





- LEGEND:**
- Site Reference Location
  - Approximate Footprint of the Former Smelter Facility

**PROJECT:**  
 Lake Erie Smelting Corp.

**CLIENT NAME:**  
 EPA

**TITLE:**  
 Site Map (Historical)  
 Lake Erie Smelting Corp.  
 29 Superior Street, Buffalo, NY



**DATE:**  
 May 2015

**FIGURE #:**  
 1





Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

<b>Legend</b> <div style="display: flex; justify-content: space-between;"> <div> <p><span style="color: green;">●</span> Sample Location (50 ft spacing)</p> <p><span style="color: blue;">■</span> Sample Location (100 ft spacing)</p> <p><span style="color: yellow;">▲</span> Sample Location (200 ft spacing)</p> <p> Former Smelter Footprint (approximate)</p> </div> <div> <p> Parcel Boundary</p> <p> Sample Grid (50 ft spacing)</p> </div> </div>		<b>Notes:</b> 1: Total of 52 sample locations 50 ft spacing - 27 sample locations 100 ft spacing - 8 sample locations 200 ft spacing - 17 sample locations 2: ft - feet			<div style="text-align: center;"> <b>Weston Solutions, Inc.</b>  <b>East Division</b>            In Association With            Scientific and Environmental Associates, Inc.,            Environmental Compliance Consultants, Inc.,            Avatar Environmental, LLC, On-Site Environmental,            Inc. and Sovereign Consulting, Inc         </div>	<b>Figure 2:</b> <b>Proposed Sample Locations</b> <div style="text-align: center;">             LAKE ERIE SMELTER              BUFFALO, NEW YORK           </div>
		U.S. ENVIRONMENTAL PROTECTION AGENCY REMOVAL SUPPORT TEAM 2 CONTRACT # EP-S2-14-01				

GIS ANALYST: P. LISICHENKO EPA OSC: D. ROSOFF / M. BELLIS RST SPM: P. LISICHENKO FILENAME: 150722_LES_SampleLocationMap.mxd	DATE MODIFIED: 7/22/2015
--	--------------------------



**ATTACHMENT B:**

Quality Assurance Project Plan (QAPP)

Health and Safety Plan (HASP)



Weston Solutions, Inc.  
Suite 201  
1090 King Georges Post Road  
Edison, New Jersey 08837-3703  
732-585-4400 • Fax: 732-225-7037  
www.westonsolutions.com

*The Trusted Integrator for Sustainable Solutions*

REMOVAL SUPPORT TEAM 3  
EPA CONTRACT EP-S2-14-01

July 24, 2015

Mr. David Rosoff, On-Scene Coordinator  
U.S. Environmental Protection Agency, Region II  
Removal Action Branch  
2890 Woodbridge Avenue  
Edison, New Jersey 08837

**EPA CONTRACT No.: EP-S2-14-01**

**TDD No.: TO-0006-0056**

**DOCUMENT CONTROL No.: DCN: RST3-02-D-0018**

**SUBJECT: SITE-SPECIFIC UFP QUALITY ASSURANCE PROJECT PLAN – LAKE  
ERIE SMELTING ASSESSMENT SITE, BUFFALO, ERIE COUNTY, NEW  
YORK**

Dear Mr. Rosoff,

Enclosed please find the Site-Specific Uniform Federal Policy (UFP) Quality Assurance Project Plan (QAPP) for the Removal Assessment soil sampling and X-RAY Fluorescence (XRF) screening to be conducted at the Lake Erie Smelting Assessment Site located in Buffalo, New York beginning on August 3, 2015.

If you have any questions or comments, please do not hesitate to contact me at (603) 512-4350.

Sincerely,

WESTON SOLUTIONS, INC

Peter Lisichenko  
RST 3 Site Project Manager

Enclosure

cc: TDD File No.: TO-0006-0056

*an employee-owned company*

In association with Scientific and Environmental Associates, Inc.,  
Environmental Compliance Consultants, Inc., Avatar Environmental, LLC,  
On-Site Environmental, Inc., and Sovereign Consulting, Inc.



**SITE-SPECIFIC UFP  
QUALITY ASSURANCE PROJECT PLAN  
LAKE ERIE SMELTING ASSESSMENT SITE  
Buffalo, Erie County, New York**

Prepared By:

Removal Support Team 3  
Weston Solutions, Inc.  
Engineering, Science, and Technology Division  
Edison, New Jersey 08837

DC No.: RST3-02-D-0018  
TDD No.: TO-0006-0056  
EPA Contract No.: EP-S2-14-01

July 2015

## TABLE OF CONTENTS

<b>CROSSWALK.....</b>	<b>1</b>
<b>QAPP Worksheet #1: Title and Approval Page.....</b>	<b>4</b>
<b>QAPP Worksheet #2: QAPP Identifying Information .....</b>	<b>5</b>
<b>QAPP Worksheet #3: Distribution List .....</b>	<b>6</b>
<b>QAPP Worksheet #4: Project Personnel Sign-Off Sheet.....</b>	<b>9</b>
<b>QAPP Worksheet #5: Project Organizational Chart .....</b>	<b>8</b>
<b>QAPP Worksheet #6: Communication Pathways.....</b>	<b>9</b>
<b>QAPP Worksheet #7: Personnel Responsibilities and Qualifications Table .....</b>	<b>9</b>
<b>QAPP Worksheet #8: Special Personnel Training Requirements Table.....</b>	<b>10</b>
<b>QAPP Worksheet #9: Project Scoping Session Participants Sheet .....</b>	<b>11</b>
<b>QAPP Worksheet #10: Problem Definition .....</b>	<b>12</b>
<b>QAPP Worksheet #11: Project Quality Objectives/Systematic Planning Process Statement</b>	<b>14</b>
<b>QAPP Worksheet #12: Measurement Performance Criteria Table.....</b>	<b>15</b>
<b>QAPP Worksheet #13: Secondary Data Criteria and Limitations Table.....</b>	<b>16</b>
<b>QAPP Worksheet #14: Summary of Project Tasks .....</b>	<b>17</b>
<b>QAPP Worksheet #15: Reference Limits and Evaluation Table.....</b>	<b>21</b>
<b>QAPP Worksheet #16: Project Schedule/Timeline Table .....</b>	<b>23</b>
<b>QAPP Worksheet #17: Sampling Design and Rationale .....</b>	<b>24</b>
<b>QAPP Worksheet #18: Sampling Locations and Methods/SOP Requirements Table .....</b>	<b>26</b>
<b>QAPP Worksheet #19: Analytical SOP Requirements Table.....</b>	<b>26</b>
<b>QAPP Worksheet #20: Field Quality Control Sample Summary Table.....</b>	<b>27</b>
<b>QAPP Worksheet #21: Project Sampling SOP References Table .....</b>	<b>27</b>
<b>QAPP Worksheet #22: Field Equipment Calibration, Maintenance, Testing, and Inspection Table.....</b>	<b>28</b>
<b>QAPP Worksheet #23: Analytical SOP References Table .....</b>	<b>28</b>
<b>QAPP Worksheet #24: Analytical Instrument Calibration Table .....</b>	<b>29</b>
<b>QAPP Worksheet #25: Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table .....</b>	<b>29</b>
<b>QAPP Worksheet #26: Sample Handling System .....</b>	<b>30</b>
<b>QAPP Worksheet #27: Sample Custody Requirements .....</b>	<b>31</b>
<b>QAPP Worksheet #28: QC Samples Table.....</b>	<b>32</b>
<b>QAPP Worksheet #29: Project Documents and Records Table .....</b>	<b>34</b>
<b>QAPP Worksheet #30: Analytical Services Table.....</b>	<b>34</b>
<b>QAPP Worksheet #31: Planned Project Assessments Table.....</b>	<b>35</b>
<b>QAPP Worksheet #32: Assessment Findings and Corrective Action Responses.....</b>	<b>36</b>
<b>QAPP Worksheet #33: QA Management Reports Table .....</b>	<b>37</b>
<b>QAPP Worksheet #34: Verification (Step I) Process Table .....</b>	<b>38</b>
<b>QAPP Worksheet #35: Validation (Steps IIa and IIb) Process Table.....</b>	<b>39</b>
<b>QAPP Worksheet #36: Validation (Steps IIa and IIb) Summary Table.....</b>	<b>40</b>
<b>QAPP Worksheet #37: Usability Assessment .....</b>	<b>41</b>



## **ATTACHMENTS**

**ATTACHMENT A:** Figure 1: Site Location Map

**ATTACHMENT B:** Sampling SOPs

- EPA/ERT SOP# 2001
- EPA/ERT SOP# 2006
- EPA/ERT SOP# 2012

**ATTACHMENT C:** EPA Regional Removal Management Levels (RML) Residential Soil  
Table (TR=1E-6, HQ=3) January 2015

## **LIST OF ACRONYMS**

ADR	Automated Data Review
ANSETS	Analytical Services Tracking System
AOC	Acknowledgment of Completion
ASTM	American Society for Testing and Materials
CEO	Chief Executive Officer
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CLP	Contract Laboratory Program
CFM	Contract Financial Manager
CO	Contract Officer
COI	Conflict of Interest
COO	Chief Operations Officer
CRDL	Contract Required Detection Limit
CRTL	Core Response Team Leader
CRQL	Contract Required Quantitation Limit
CQLOSS	Corporate Quality Leadership and Operations Support Services
CWA	Clean Water Act
DCN	Document Control Number
DESA	Division of Environmental Science and Assessment
DI	Deionized Water
DPO	Deputy Project Officer
DQI	Data Quality Indicator
DQO	Data Quality Objective
EM	Equipment Manager
EDD	Electronic Data deliverable
ENVL	Environmental Unit Leader
EPA	Environmental Protection Agency
ERT	Environmental Response Team
FASTAC	Field and Analytical Services Teaming Advisory Committee
GC/ECD	Gas Chromatography/Electron Capture Detector
GC/MS	Gas Chromatography/Mass Spectrometry
HASP	Health and Safety Plan
HRS	Hazard Ranking System
HSO	Health and Safety Officer
ITM	Information Technology Manager
LEL	Lower Explosive Limit
MSA	Mine Safety Appliances
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NELAC	National Environmental Laboratory Accreditation Conference
NELAP	National Environmental Laboratory Accreditation Program
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
OSC	On-Scene Coordinator
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response

### **LIST OF ACRONYMS (Concluded)**

PARCCS	Precision, Accuracy, Representativeness, Completeness, Comparability, Sensitivity
PAH	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PIO	Public Information Officer
PM	Program Manager
PO	Project Officer
PRP	Potentially Responsible Party
PT	Proficiency Testing
QA	Quality Assurance
QAL	Quality Assurance Leader
QAPP	Quality Assurance Project Plan
QMP	Quality Management Plan
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
RC	Readiness Coordinator
RCRA	Resource Conservation and Recovery Act
RML	Removal Management Level
RPD	Relative Percent Difference
RSCC	Regional Sample Control Coordinator
RST	Removal Support Team
SARA	Superfund Amendments and Reauthorization Act
SEDD	Staged Electronic Data Deliverable
SOP	Standard Operating Practice
SOW	Statement of Work
SPM	Site Project Manager
START	Superfund Technical Assessment and Response Team
STR	Sampling Trip Report
TAL	Target Analyte List
TCL	Total Compound List
TDD	Technical Direction Document
TDL	Technical Direction Letter
TO	Task Order
TQM	Total Quality Management
TSCA	Toxic Substances Control Act
UFP	Uniform Federal Policy
VOA	Volatile Organic Analysis

## CROSSWALK

The following table provides a “cross-walk” between the QAPP elements outlined in the Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP Manual), the necessary information, and the location of the information within the text document and corresponding QAPP Worksheet. Any QAPP elements and required information that are not applicable to the project are circled.

QAPP Element(s) and Corresponding Section(s) of UFP-QAPP Manual		Required Information	Crosswalk to QAPP Section	Crosswalk to QAPP Worksheet No.
<b>Project Management and Objectives</b>				
2.1	Title and Approval Page	- Title and Approval Page	Approval Page	1
2.2	Document Format and Table of Contents	- Table of Contents	TOC	2
2.2.1	Document Control Format	- QAPP Identifying Information	Approval Page	
2.2.2	Document Control Numbering System			
2.2.3	Table of Contents			
2.2.4	QAPP Identifying Information			
2.3	Distribution List and Project Personnel Sign-Off Sheet	- Distribution List	Approval Page	3
2.3.1	Distribution List	- Project Personnel Sign-Off Sheet		4
2.3.2	Project Personnel Sign-Off Sheet			
2.4	Project Organization	- Project Organizational Chart	2	5
2.4.1	Project Organizational Chart	- Communication Pathways		6
2.4.2	Communication Pathways	- Personnel Responsibilities and Qualifications		7
2.4.3	Personnel Responsibilities and Qualifications	- Special Personnel Training Requirements		8
2.4.4	Special Training Requirements and Certification			
2.5	Project Planning/Problem Definition	- Project Planning Session Documentation (including Data Needs tables)	1	
2.5.1	Project Planning (Scoping)	- Project Scoping Session Participants Sheet		9
2.5.2	Problem Definition, Site History, and Background	- Problem Definition, Site History, and Background		10
		- Site Maps (historical and present)		
2.6	Project Quality Objectives and Measurement Performance Criteria	- Site-Specific PQOs	3	11
2.6.1	Development of Project Quality Objectives Using the Systematic Planning Process	- Measurement Performance Criteria		12
2.6.2	Measurement Performance Criteria			
2.7	Secondary Data Evaluation	- Sources of Secondary Data and Information	1	13
		- Secondary Data Criteria and Limitations	2	



QAPP Element(s) and Corresponding Section(s) of UFP-QAPP Manual		Required Information	Crosswalk to QAPP Section	Crosswalk to QAPP Worksheet No.
2.8	Project Overview and Schedule	- Summary of Project Tasks	4	14
2.8.1	Project Overview	- Reference Limits and Evaluation		15
2.8.2	Project Schedule	- Project Schedule/Timeline		16
<b>Measurement/Data Acquisition</b>				
3.1	Sampling Tasks	- Sampling Design and Rationale	5	17
3.1.1	Sampling Process Design and Rationale	- Sample Location Map		18
3.1.2	Sampling Procedures and Requirements	- Sampling Locations and Methods/SOP Requirements		19
3.1.2.1	Sampling Collection Procedures	- Analytical Methods/SOP Requirements		20
3.1.2.2	Sample Containers, Volume, and Preservation	- Field Quality Control		21
3.1.2.3	Equipment/Sample Containers Cleaning and Decontamination Procedures	- Sample Summary		21
3.1.2.4	Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures	- Sampling SOPs		22
3.1.2.5	Supply Inspection and Acceptance Procedures	- Project Sampling SOP		22
3.1.2.6	Field Documentation Procedures	- References		22
3.2	Analytical Tasks	- Field Equipment Calibration, Maintenance, Testing, and Inspection		
3.2.1	Analytical SOPs	- Analytical SOPs	6	23
3.2.2	Analytical Instrument Calibration Procedures	- Analytical SOP References		24
3.2.3	Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures	- Analytical Instrument Calibration		25
3.2.4	Analytical Supply Inspection and Acceptance Procedures	- Analytical Instrument and Equipment Maintenance, Testing, and Inspection		
3.3	Sample Collection Documentation, Handling, Tracking, and Custody Procedures	- Sample Collection Documentation	7	27
3.3.1	Sample Collection, Documentation	- Handling, Tracking, and Custody SOPs		
3.3.2	Sample Handling and Tracking System	- Sample Container Identification		26
3.3.3	Sample Custody	- Sample Handling Flow Diagram		
		- Example Chain-of-Custody Form and Seal		
3.4	Quality Control Samples	- QC Samples	5	28
3.4.1	Sampling Quality Control Samples	- Screening/Confirmatory Analysis Decision Tree		
3.4.2	Analytical Quality Control Samples			

QAPP Element(s) and Corresponding Section(s) of UFP-QAPP Manual		Required Information	Crosswalk to QAPP Section	Crosswalk to QAPP Worksheet No.
3.5	Data Management Tasks	- Project Documents and Records	6	29
3.5.1	Project Documentation and Records	- Analytical Services		30
3.5.2	Data Package Deliverables	- Data Management SOPs		
3.5.3	Data Reporting Formats			
3.5.4	Data Handling and Management			
3.5.5	Data Tracking and Control			
<b>Assessment/Oversight</b>				
4.1	Assessments and Response Actions	- Assessments and Response Actions	8	31
4.1.1	Planned Assessments	- Planned Project Assessments		32
4.1.2	Assessment Findings and Corrective Action Responses	- Audit Checklists		
		- Assessment Findings and Corrective Action Responses		
4.2	QA Management Reports	- QA Management Reports		33
4.3	Final Project Report	- Final Report(s)		
<b>Data Review</b>				
5.1	Overview			
5.2	Data Review Steps	- Verification (Step I) Process	9	34
5.2.1	Step I: Verification			
5.2.2	Step II: Validation	- Validation (Steps IIa and IIb) Process		35
5.2.2.1	Step IIa Validation Activities	- Validation (Steps IIa and IIb) Summary		36
5.2.2.2	Step IIb Validation Activities	- Usability Assessment		37
5.2.3	Step III: Usability Assessment			
5.2.3.1	Data Limitations and Actions from Usability Assessment			
5.2.3.2	Activities			

**QAPP Worksheet #1: Title and Approval Page**

**Title:** Site-Specific Quality Assurance Project Plan  
**Site Name/Project Name:** Lake Erie Smelting Assessment Site  
**Site Location:** 440 Clinton Street, Buffalo, Erie County, New York  
**Revision Number:** 00  
**Revision Date:** Not Applicable

Weston Solutions, Inc.

**Lead Organization**

Robert Croskey  
Weston Solutions, Inc.  
1090 King Georges Post Road, Suite 201  
Edison, New Jersey 08837  
Email: robert.croskey@westonsolutions.com

**Preparer's Name and Organizational Affiliation**

23 July 2015

**Preparation Date (Day/Month/Year)**

Site Project Manager:

  
Signature

Peter Lisichenko/Weston Solutions, Inc.

**Printed Name/Organization/Date**

QA Officer/Technical Reviewer:

  
Signature

Smita Sumbaly/Weston Solutions, Inc.

**Printed Name/Organization/Date**

EPA, Region II On-Scene Coordinator (OSC):

\_\_\_\_\_  
Signature

David Rosoff/EPA, Region II

**Printed Name/Organization/Date**

EPA, Region II Quality Assurance Officer (QAO):

\_\_\_\_\_  
Signature

**Printed Name/Organization/Date**

Document Control Number: RST3-02-D-0018

## **QAPP Worksheet #2: QAPP Identifying Information**

**Site Name/Project Name:** Lake Erie Smelting Assessment Site  
**Site Location:** 440 Clinton Street, Buffalo, Erie County, New York  
**Operable Unit:** 00  
**Title:** Site-Specific Quality Assurance Project Plan  
**Revision Number:** 00  
**Revision Date:** Not Applicable

- 1. Identify guidance used to prepare QAPP:** Uniform Federal Policy for Quality Assurance Project Plans. Refer to EPA/ERT SOPs and CLP analytical method ISM01.3.
- 2. Identify regulatory program:** EPA, Region II
- 3. Identify approval entity:** EPA, Region II
- 4. Indicate whether the QAPP is a generic or a Site-specific QAPP.**
- 5. List dates of scoping sessions that were held:** July 16, 2015
- 6. List dates and titles of QAPP documents written for previous site work, if applicable:**  
None
- 7. List organizational partners (stakeholders) and connection with lead organization:**  
None
- 8. List data users:** EPA, Region II (see Worksheet #4 for individuals)
- 9. If any required QAPP elements and required information are not applicable to the project, then provide an explanation for their exclusion below:**  
None
- 10. Document Control Number:** RST3-02-D-0018



### QAPP Worksheet #3: Distribution List



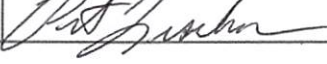
[List those entities to which copies of the approved QAPP, subsequent QAPP revisions, addenda, and amendments are sent]

QAPP Recipient	Title	Organization	Telephone Number	Fax Number	E-mail Address	Document Control Number
David Rosoff	On-Scene Coordinator	EPA, Region II	(732) 906-6879	(732) 906-6182	<a href="mailto:Rosoff.david@epa.gov">Rosoff.david@epa.gov</a>	RST3-02-D-0018
Peter Lisichenko	Site Project Manager	Weston Solutions, Inc., RST 3	(603) 512-4350	(732) 225-7037	<a href="mailto:Peter.Lisichenko@westonsolutions.com">Peter.Lisichenko@westonsolutions.com</a>	RST3-02-D-0018
Smita Sumbaly	QA Officer	Weston Solutions, Inc., RST 3	(732) 585-4410	(732) 225-7037	<a href="mailto:S.Sumbaly@westonsolutions.com">S.Sumbaly@westonsolutions.com</a>	RST3-02-D-0018
Timothy Benton	HSO	Weston Solutions, Inc., RST 3	(732) 585-4425	(732) 225-7037	<a href="mailto:Timothy.Benton@westonsolutions.com">Timothy.Benton@westonsolutions.com</a>	RST3-02-D-0018
Site TDD File	RST 3 Site TDD File	Weston Solutions, Inc., RST 3	Not Applicable	Not Applicable	Not Applicable	-

### QAPP Worksheet #4: Project Personnel Sign-Off Sheet

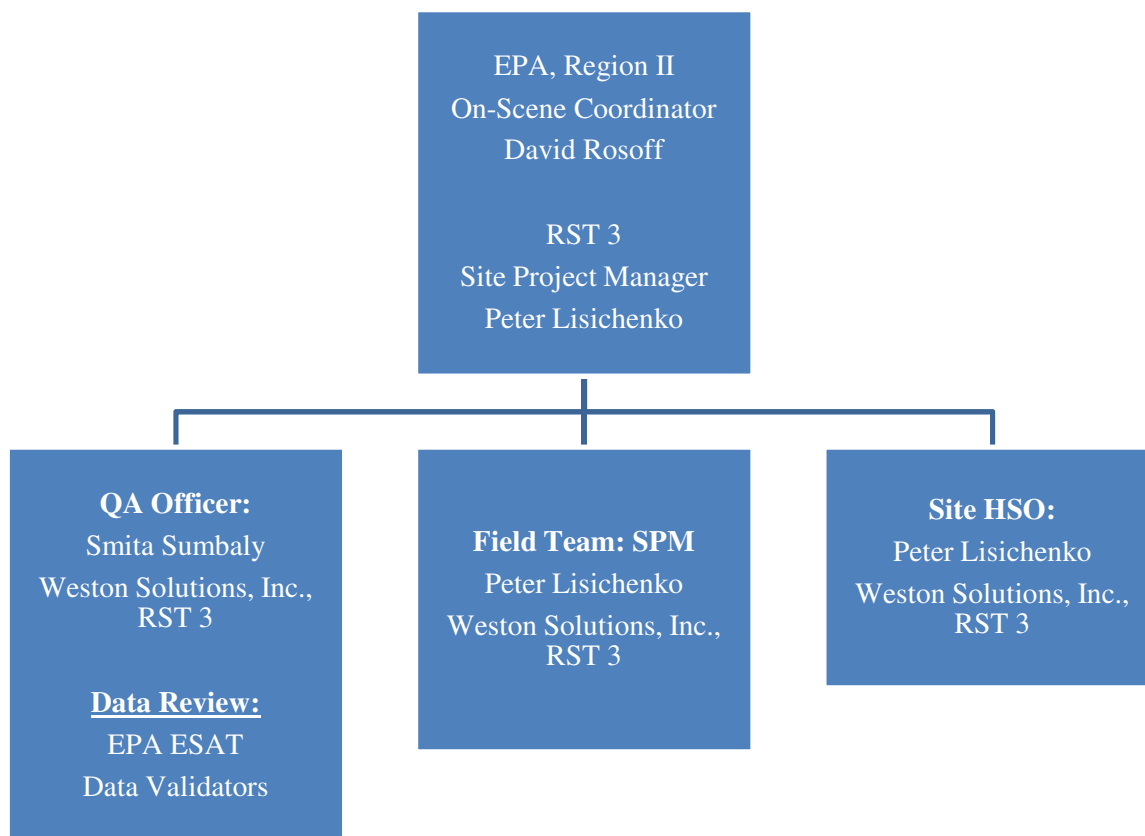
[Copies of this form signed by key project personnel from each organization to indicate that they have read the applicable sections of the QAPP and will perform the tasks as described; add additional sheets as required. Ask each organization to forward signed sheets to the central project file.]

Organization: Weston Solutions, Inc.

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
David Rosoff	EPA, Region II, On-Scene Coordinator	(732) 906-6879		
Smita Sumbaly	QAO, RST 3	(732) 585-4410		7/23/15
Timothy Benton	HSO, RST 3	(732) 585-4425		7/23/15
Peter Lisichenko	SPM, RST 3	(603) 512-4350		8/23/15

### QAPP Worksheet #5: Project Organizational Chart

Identify reporting relationship between all organizations involved in the project, including the lead organization and all contractor and subcontractor organizations. Identify the organizations providing field sampling, on-site and off-site analysis, and data review services, including the names and telephone numbers of all project managers, project team members, and/or project contacts for each organization.



**Acronyms:**

SPM: Site Project Manager  
HSO: Health & Safety Officer  
ESAT: Environmental Services Assistance Team

### QAPP Worksheet #6: Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure
Point of contact with EPA OSC	Site Project Manager, Weston Solutions, Inc., RST 3	Peter Lisichenko, SPM	(603) 512-4350	All technical, QA and decision-making matters in regard to the project (verbal, written or electronic)
Adjustments to QAPP	Site Project Manager, Weston Solutions, Inc., RST 3	Peter Lisichenko, SPM	(603) 512-4350	QAPP approval dialogue
Health and Safety On-Site Meeting	Site Project Manager, Weston Solutions, Inc., RST 3	Peter Lisichenko, SPM	(603) 512-4350	Explain/ review site hazards, personnel protective equipment, hospital location, etc.

EPA: U.S. Environmental Protection Agency  
OSC: On-Scene Coordinator

RST: Removal Support Team  
SPM: Site Project Manager

QA: Quality Assurance  
QAPP: Quality Assurance Project Plan

### QAPP Worksheet #7: Personnel Responsibilities and Qualifications Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications*
David Rosoff	EPA On-Scene Coordinator	EPA, Region 2	All project coordination, direction and decision making.	NA
Peter Lisichenko	Site Project Manager, RST 3	Weston Solutions, Inc.	Implementing and executing the technical, QA and health and safety during the sampling event and sample management.	14 years+*

\*All RST 3 members, including subcontractor's resumes are in possession of RST 3 Program Manager, EPA Project Officer and Contracting officers.



**QAPP Worksheet #8: Special Personnel Training Requirements Table**

<b>Project Function</b>	<b>Specialized Training By Title or Description of Course</b>	<b>Training Provider</b>	<b>Training Date</b>	<b>Personnel / Groups Receiving Training</b>	<b>Personnel Titles / Organizational Affiliation</b>	<b>Location of Training Records / Certificates<sup>1</sup></b>
<b>[Specify location of training records and certificates for samplers]</b>						
QAPP Training	This training is presented to all RST 3 personnel to introduce the provisions, requirements, and responsibilities detailed in the UFP QAPP. The training presents the relationship between the site-specific QA Project Plans (QAPPs), SOPs, work plans, and the Generic QAPP. QAPP refresher training will be presented to all employees following a major QAPP revision.	Weston Solutions, Inc., QAO	As needed	All RST 3 field personnel upon initial employment and as refresher training	Weston Solutions, Inc.	Weston Solutions, Inc., EHS Database
Health and Safety Training	Health and safety training will be provided to ensure compliance with Occupational Safety and Health Administration (OSHA) as established in 29 CFR 1910.120.	Weston Solutions, Inc., HSO	Yearly at a minimum	All Employees upon initial employment and as refresher training every year	Weston Solutions, Inc.	Weston Solutions, Inc., EHS Database
Others	Scribe, ICS 100 and 200, and Air Monitoring Equipment Trainings provided to all employees	Weston Solutions, Inc., QAO/Group Leader's	Upon initial employment and as needed			
	Dangerous Goods Shipping	Weston Solutions, Inc., HSO	Every 2 years			

All team members are trained in the concepts and procedures in recognizing opportunities for continual improvement, and the approaches required to improve procedures while maintaining conformance with legal, technical, and contractual obligations.

<sup>1</sup> All RST 3 members, including subcontractor's certifications are in possession of RST 3 HSO.

## QAPP Worksheet #9: Project Scoping Session Participants Sheet

**Site Name/Project Name:** Lake Erie Smelting Assessment Site

**Site Location:** 440 Clinton Street, Buffalo, Erie County, New York

**Operable Unit:** 00

**Date of Session:** July 16, 2015

**Scoping Session Purpose:** To discuss questions, comments, and assumptions regarding technical issues involved with the sampling activities.

Name	Title	Affiliation	Phone #	E-mail Address	*Project Role
David Rosoff	EPA OSC	EPA, Region II	(732) 906-6879	Rosoff.david@epa.gov	OSC
Timothy Benton	HSO	Weston Solutions, Inc., RST 3	(732) 585-4425	<a href="mailto:Timothy.Benton@westonsolutions.com">Timothy.Benton@westonsolutions.com</a>	QA
Peter Lisichenko	Site Project Manager	Weston Solutions, Inc., RST 3	(603) 512-4350	<a href="mailto:Peter.Lisichenko@westonsolutions.com">Peter.Lisichenko@westonsolutions.com</a>	SPM, HSO, Field Lead

### Comments/Decisions:

Upon the request of the U.S. Environmental Protection Agency (EPA), Weston Solutions, Inc., Removal Support Team 3 (RST 3) has been tasked with conducting an on-site assessment at the former Lake Erie Smelting Site at 440 Clinton Street, Buffalo, New York (currently occupied by Towne Garden apartments). Tasks to include collecting soil samples at depth (0-1", 1-6", 6-12", 12-18", and 18-24" intervals) at 52 locations, field screening all samples via X-Ray Fluorescence (XRF) analyzer for lead, and submitting up to 30 percent of the samples for laboratory analysis for TAL Metals including tin (Sn). Additional sampling may be collected as directed by the OSC. The soil samples will be collected for a definitive data QA Objective. Field duplicate and Matrix Spike/Matrix Spike Duplicate (MS/MSD) soil samples will be collected at a frequency of one per 20 samples. A rinsate blank sample will be collected on each day of soil sampling activities to demonstrate adequate decontamination of non-dedicated sampling devices (i.e. hand augers and shovels). RST 3 is to document the field event through photos and a daily log book for the estimated one week of Site activities. Identifying subsurface utilities may be necessary.

### Action Items:

The CLP Request Form was submitted on July 23, 2015

### Consensus Decisions:

Field activities as part of the Removal Assessment will tentatively begin on August 3, 2015 and will be completed in approximately one week.

## **QAPP Worksheet #10: Problem Definition**

### **PROBLEM DEFINITION**

The soil sampling to be conducted as part of the EPA Removal Assessment at the Site is tentatively scheduled to begin on August 3, 2015. As part of the Removal Assessment sampling event, RST 3 is tasked with the collection of soil samples from 52 locations at the 0-1", 1-6", 6-12. 12-18", and 18-24" intervals, the field screening of soils for lead concentrations via XRF, and submitting up to 30 percent of the samples for TAL metals plus tin laboratory analysis for XRF correlation. The analytical data from this investigation will be used to assist the EPA in determining the nature and extent of contaminated soil within and outside of the historic on-site facility footprint.

### **SITE HISTORY/CONDITIONS**

The Lake Erie Smelting Corporation (LES) is the location of a former secondary lead smelter that occupied approximately 13,000 square feet (ft<sup>2</sup>) at the historical address of 29 Superior Street, Buffalo, Erie County, New York. The footprint of the former facility currently lies north of Clinton Street and west of Jefferson Street within the Towne Gardens apartment complex and is now occupied by two of the Towne Gardens' apartment units.

The LES facility appears to have been a secondary smelter from approximately 1935 to the mid-1960s. The property was included in a list of hundreds of locations nationwide where secondary lead smelting or alloying might have been conducted between 1931 and 1964. The list was originally compiled by William P. Eckel in a doctoral dissertation for George Mason University and was based on entries in historical trade publications.

Secondary lead smelting is the recovery of lead metal and alloys from scrap, including lead-acid batteries, lead cable coverings, plumbing, type metal, and wheel weights. The chief alloy recovered for many years by secondary smelters was antimonial lead. Besides scrapped batteries, sources of scrap included drosses (by-products of lead refining), battery plant scrap, old pipes or roof flashing, cable sheathing, solder, and Babbitt metal, which are a group of lead-tin-antimony alloys used as antifriction metals in wheel bearings. Near many stationary sources, such as smelters, lead concentrations in soil may reach very high percentage levels and may persist in the surface soils (*i.e.*, 0.8 to 2 inches). Lead in soil and dust is a primary source of environmental lead exposure. LES, which operated as a secondary smelter, may have been responsible for releasing large amounts of lead contamination into the surrounding environment for a time period of approximately 30 years, from the mid-1930s to the mid-1960s. The facility also produced and consumed lead-tin-antimony alloys (*i.e.*, Babbitt metal); therefore, there was a potential for tin and antimony to be contained in any historical releases from the facility.

Towne Gardens is a residential apartment complex consisting of 360 total units. The housing units are surrounded by grass-covered lawns, concrete sidewalks, and asphalt-paved parking lots. The former LES facility footprint lies in the northeastern portion of the complex near Jefferson Avenue. Two of the residential apartment buildings and adjacent grass-covered areas occupy a portion of the footprint, as well as an attached single story building that appears to be an office. To the north of the

### **QAPP Worksheet #10: Problem Definition (concluded)**

footprint is one of the complex's parking lots and a commercial property. A residential area is located east and northeast of the Site.

According to available wind rose plots, the prevailing wind direction in Buffalo is approximately southwest to northeast, indicating that a residential neighborhood is downwind of the former smelter location. Site topography is flat; runoff from the Site is likely intercepted by storm drains located within the parking lot located immediately north of the former LES facility footprint.

In October 2014, soil samples were collected by the U.S. Environmental Protection Agency's (EPA) Site Assessment Team (SAT) contractor. These samples were collected from off-site locations from the Towne Garden complex at both upwind (background) and downwind directions based on the wind rose plots. Collected at various intervals down to 24 inches below ground surface (bgs), samples were analyzed for EPA target analyte list (TAL) metals, including tin. Results from these samples indicate a greater than three-fold increase in concentrations between the upwind (background) and downwind samples. Furthermore, there were corresponding increases in antimony as well as tin results between the upwind and downwind samples, supporting a correlation to operations at LES.

### **PROJECT DESCRIPTION**

In order to conduct a removal assessment of the Site, RST 3 has been tasked with conducting an on-site assessment at the former Lake Erie Smelting Site at 440 Clinton Street, Buffalo, New York (currently occupied by Towne Garden apartments). Tasks to include collecting soil samples at depth (0-1", 1-6", 6-12", 12-18", and 18-24" intervals) at 52 locations, field screening all samples via X-Ray Fluorescence (XRF) analyzer for lead, and submitting up to 30 percent of the samples for laboratory analysis for TAL Metals including tin (Sn). Additional sampling may be collected as directed by the OSC. The soil samples will be collected for a definitive data QA Objective. Field duplicate and Matrix Spike/Matrix Spike Duplicate (MS/MSD) soil samples will be collected at a frequency of one per 20 samples. A rinsate blank sample will be collected on each day of soil sampling activities to demonstrate adequate decontamination of non-dedicated sampling devices (*i.e.* hand augers and shovels). RST 3 is to document the field event through photos and a daily log book for the estimated one week of Site activities. Identifying subsurface utilities may be necessary.

### **OBSERVATION FROM ANY SITE RECONNAISSANCE REPORT**

None at this time.

### **PROJECT DECISION STATEMENTS**

EPA will use the analytical data to indicate if soil analysis exceeds EPA's Removal Management Levels (RML) and extent of off-site soil contamination.

## **QAPP Worksheet #11: Project Quality Objectives/Systematic Planning Process Statement**

**Overall project objectives include:** Sampling will be conducted by RST 3 to determine the presence of elevated concentrations of lead and other metals within the Site.

**Who will use the data?** Data will be used by the EPA, Region II OSC and may be utilized by the EPA Region II Pre-remedial Section.

**What will the data be used for?** The analytical data from this investigation will be used to assist the EPA in determining the nature and extent of lead contamination and whether the soil on the Site contains elevated concentrations of metals requiring a removal action.

### **What types of data are needed?**

Matrix:	Soil and aqueous rinsate blank samples
Type of Data:	Definitive data for soil samples
Analytical Techniques:	Off-site laboratory analyses
Parameters:	TAL Metals, Tin
Type of sampling equipment:	Plastic scoops, sample jars, and ziplock bags
Access Agreement:	Obtained by EPA, Region II OSC
Sampling locations:	The location of the soil samples will be collected from areas determined by the OSC.

**How much data are needed?** Up to 82 soil samples for laboratory analysis (including nine field duplicate samples) are anticipated to be collected from sample locations throughout the Site. One rinsate blank will be collected daily. The samples collected will be submitted for laboratory analysis.

### **How “good” does the data need to be in order to support the environmental decision?**

Sampling/analytical measurement performance criteria for Precision, Accuracy, Representativeness, Completeness, and Comparability (PARCC) parameters will be established. Refer to Worksheet #12, criteria for performance measurement for definitive data.

**Where, when, and how should the data be collected/generated?** The soil samples to be collected from the Site have been determined and approved by the EPA OSC. All samples will be collected using methods outlined in the EPA/ERT SOPs. The sampling event is tentatively scheduled to begin on August 3, 2015.

**Who will collect and generate the data?** The soil samples will be collected by RST 3. Samples will be analyzed by the CLP laboratory and validated by EPA’s ESAT data validators.

**How will the data be reported?** All data will be reported by the assigned laboratory (Preliminary, Electronic, and Hard Copy format). The SPM will provide a STR, Status Reports, Maps/Figures, Analytical Report, and Data Validation Report to the EPA OSC.

**How will the data be archived?** Electronic data deliverables (EDDs) will be archived in a Scribe database.

## QAPP Worksheet #12: Measurement Performance Criteria Table

(UFP-QAPP Manual Section 2.6.2)

Complete this worksheet for each matrix, analytical group, and concentration level. Identify the data quality indicators (DQI), measurement performance criteria (MPC) and QC sample and/or activity used to assess the measurement performance for both the sampling and analytical measurement systems. Use additional worksheets if necessary. If MPC for specific DQI vary within an analytical parameter, i.e., MPC are analyte-specific, then provide analyte-specific MPC on an additional worksheet.

<b>Matrix</b>		Soil and Aqueous <sup>3</sup>			
<b>Analytical Group</b>		TAL Metals + Sn			
<b>Concentration Level</b>		ICP-AES (mg/kg)			
<b>Sampling Procedure<sup>1</sup></b>	<b>Analytical Method/SOP<sup>2</sup></b>	<b>Data Quality Indicators (DQIs)</b>	<b>Measurement Performance Criteria</b>	<b>QC Sample and/or Activity Used to Assess Measurement Performance</b>	<b>QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&amp;A)</b>
EPA ERT SOPs 2001 and 2012	ISM01.3	Precision (field)	≤ 35% RPD*	Field Duplicate	S & A
		Accuracy (field)	No analyte > CRQL*	Field Blank	S & A
		Precision (laboratory)	≤ 20% RPD*	Duplicate Sample **	A
		Accuracy (laboratory)	75-125%; 70-130%	*** Matrix Spike; LCS****	A

<sup>1</sup>Reference number from QAPP Worksheet #21.

<sup>2</sup>Reference number from QAPP Worksheet #23.

\*Reference USEPA Region 2 ICP-AES Data Validation SOP most recent revision  
<http://www.epa.gov/region2/qa/documents.htm> (include absolute difference criteria)

\*\* Reference USEPA CLP ISM01.3 (2010), Exhibit D of ICP-AES for Duplicate Sample Analysis, p. D-22 (include absolute difference criteria)

\*\*\*Reference USEPA CLP ISM01.3 (2010), Exhibit D of ICP-AES for Spike Sample Analysis, p. D-21

\*\*\*\*Reference USEPA CLP ISM01.3 (2010), Exhibit D of ICP-AES for Laboratory Control Sample (LCS), p. D-23 Criteria w/exception of Ag and Sb 3 Aqueous samples will consist of rinsate blank samples only.

<sup>3</sup>Aqueous field duplicate and MS/MSD samples will not be collected.

### QAPP Worksheet #13: Secondary Data Criteria and Limitations Table

Any data needed for project implementation or decision making that are obtained from non-direct measurement sources such as computer databases, background information, technologies and methods, environmental indicator data, publications, photographs, topographical maps, literature files and historical data bases will be compared to the DQOs for the project to determine the acceptability of the data. Thus, for example, analytical data from historical surveys will be evaluated to determine whether they satisfy the validation criteria for the project and to determine whether sufficient data was provided to allow an appropriate validation to be done. If not, then a decision to conduct additional sampling for the site may be necessary.

<b>Secondary Data</b>	<b>Data Source (Originating Organization, Report Title, and Date)</b>	<b>Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)</b>	<b>How Data May Be Used (if deemed usable during data assessment stage)</b>	<b>Limitations on Data Use</b>
EPA Soil Investigation	NA	NA	NA	NA



## QAPP Worksheet #14: Summary of Project Tasks

### Sampling Tasks:

A sampling grid pattern will be established throughout the Site with a decreasing frequency moving away from the footprint of the former smelter. Within and adjacent to the former smelter, the sampling grid will be 50 linear feet. Stepping 100 feet latterly to the West and South, the sampling grid will expend to 100 linear feet and the remainder of the Site grid spacing will be 200 linear feet. Due to the presence of impervious surfaces (*i.e.*, sidewalks, buildings, driveways, and parking lots) the actual placement of the sampling locations will be either eliminated or latterly offset resulting in irregular patterns.

Prior to field mobilization, utility damage prevention initiatives will be enacted. Tasks include filling notification with Dig Safely New York 811 service and reviewing available Site drawings. In addition, field teams will scan sample locations with a magnetometer prior to subsurface activities.

In accordance with EPA Environmental Response Team (ERT) Standard Operating Procedure (SOP) #2012<sup>a</sup>, discrete samples will be collected from each location from the following depth intervals: 0 to 1, 1 to 6, 6 to 12, 12 to 18, and 18 to 24 inches bgs. For the 0 to 1 and 1 to 6 interval, a “plug” of sod and soil will be extracted using a spade shovel. Approximately 8 ounces of material for each interval will be collected from this “plug” using dedicated plastic scoops, placed in separate 6 x 9 polyethylene bags and labeled accordingly. For the lower depth intervals, stainless steel hand augers will be used to advance down to depth for a particular depth interval. The cores will be emptied from the barrel of the auger into 10 x 12 polyethylene bag for homogenization. Once homogenized, 8 ounces of material will be extracted using dedicated plastic scoops, placed in a 6 x 9 polyethylene bag, and labeled accordingly. Fresh nitrile gloves will be donned for each sample collected. In accordance to SOP #2006<sup>b</sup>, all non-dedicated sampling equipment (*i.e.*, hand augers) will be cleaned and washed using proper decontamination methods, including an industrial soap solution and clean water. To ensure effective decontamination of non-dedicated sampling equipment, an aqueous rinsate blank will be collected at the end of each day from a non-dedicated sampling tool used that day and submitted for TAL metals, including tin, analysis.

All soil samples collected will be screened on-site using X-ray Fluorescence (XRF) technology. Prior to analysis, samples will be dried in on-site ovens to reduce moisture content of the samples. Analysis runs will be conducted over three 60-second intervals and averaged for a final result. Results for lead screening will be recorded for each sample and entered into EPA’s SCRIBE data management system. Calibration checks will be conducted daily against calibration blanks supplied by the manufacture and documented. Up to 30 percent (%) confirmation sampling will be conducted whereby 30 % of the samples collected will be submitted to an EPA-procured laboratory for TAL metals, including tin, analysis. Selection of these samples will be as directed by the EPA On-scene Coordinator (OSC). Samples for laboratory analysis will be transferred to 8 ounce glass jars and all sampling information will be

---

<sup>a</sup> EPA ERT SOP# 2012: Soil Sampling

<sup>b</sup> EPA ERT SOP# 2006: Sampling Equipment Decontamination

### **QAPP Worksheet #14: Summary of Project Tasks (Continued)**

entered in EPA SCRIBE data management system. Quality control samples will be collected at a rate 1 per 20 samples. The analytical results will be compared to the field screening results and a correlation factor will be determined to evaluate the accuracy of the XRF analyzer.

All soil borings will be backfilled daily and locations will be restored to pre-sampling conditions as reasonably possible. Top soil and a mix grass seed blend may be used as needed for restoration purposes.

Based on the approach described above, the following quantities have been estimated for this assessment:

Total number of locations for sampling: 52

Total number of samples to be collected for field screening: 260

Total number of confirmation samples for laboratory analysis (including QA/QC): 82

Anticipated number of rinsate blanks (one per day of sampling): 4

#### **Analysis Tasks:**

Soil – Total Metal + Sn analysis – CLP Method ISM01.3

#### **Quality Control Tasks:**

The soil samples will be collected for definitive data QA objective. Field duplicate and MS/MSD samples will be collected at a rate of one per 20 per sample matrix. One rinsate blank sample will be collected daily.

#### **Data Management Tasks:**

Activities under this project will be reported in status and trip reports and other deliverables (e.g., analytical reports, final reports) described herein. Activities will also be summarized in appropriate format for inclusion in monthly and annual reports.

The following deliverables will be provided under this project:

Trip Report: A trip report will be prepared to provide a detailed accounting of what occurred during each sampling mobilization. The trip report will be prepared within two weeks of the last day of each sampling mobilization. Information will be provided on time of major events, dates, and personnel on-site (including affiliations).

Maps/Figures: Maps depicting site layout, contaminant source areas, and sample locations will be included in the trip report, as appropriate.

Analytical Report: An analytical report will be prepared for samples analyzed under the plan. This is to be provided two weeks after receiving validated data. Information regarding the analytical methods or procedures employed, samples results, QA/QC results, chain-of-custody

### **QAPP Worksheet #14: Summary of Project Tasks (Continued)**

(COC) documentation, laboratory correspondence, and raw data will be provided within this deliverable.

Data Review: A review of the data generated under this plan will be undertaken. The assessment of data acceptability or usability will be provided separately, or as part of the analytical report.

#### **Documentation and Records:**

All sample documents will be completed legibly, in ink. Any corrections or revisions will be made by lining through the incorrect entry and by initialing the error.

Field Logbook: The field logbook is essentially a descriptive notebook detailing site activities and observations so that an accurate account of field procedures can be reconstructed in the writer's absence. Field logbook will be bound and paginated. All entries will be dated and signed by the individuals making the entries, and should include (at a minimum) the following

1. Site name and project number
2. Name(s) of personnel on-site
3. Dates and times of all entries (military time preferred)
4. Descriptions of all site activities, site entry and exit times
5. Noteworthy events and discussions
6. Weather conditions
7. Site observations
8. Sample and sample location identification and description<sup>\*</sup>
9. Subcontractor information and names of on-site personnel
10. Date and time of sample collections, along with COC information
11. Record of photographs
12. Site sketches

\* The description of the sample location will be noted in such a manner as to allow the reader to reproduce the location in the field at a later date.

Sample Labels: Sample labels will clearly identify the particular sample, and should include the following:

1. Site/project number.
2. Sample identification number.
3. Sample collection date and time.
4. Designation of sample (grab or composite).
5. Sample preservation.
6. Analytical parameters.
7. Name of sampler.

Sample labels will be written in indelible ink and securely affixed to the sample container. Tie-on labels can be used if properly secured.

### **QAPP Worksheet #14: Summary of Project Tasks (Concluded)**

Custody Seals: Custody seals demonstrate that a sample container has not been tampered with or opened. The individual in possession of the sample(s) will sign and date the seal, affixing it in such a manner that the container cannot be opened without breaking the seal. The name of this individual, along with a description of the sample packaging, will be noted in the field logbook.

**Assessment/Audit Tasks**: No performance audit of field operations is anticipated at this time. If conducted, performance and system audit will be in accordance with the project plan.

**Data Review Tasks**: All data will be validated by EPA ESAT data validators.

Definitive data projects: The data generated under this QA/QC Sampling Plan will be evaluated according to guidance in the Uniform Federal Policy for Implementing Environmental Quality Systems: Evaluating, Assessing and Documenting Environmental Data Collection and Use Programs Part 1: UFP-QAPP (EPA-505-B-04-900A, March 2005); Part 2B: Quality Assurance/Quality Control Compendium: Minimum QA/QC Activities (EPA-505-B-04-900B, March 2005).

Laboratory analytical results will be assessed by the data reviewer for compliance with required precision, accuracy, completeness, representativeness, and sensitivity.

### QAPP Worksheet #15: Reference Limits and Evaluation Table

**Matrix:** Soil, Sediment  
**Analytical Group:** Target Analyte List Inorganics (ICP-AES)  
**Concentration Level:** Low

Analyte	CAS Number	Project Action Limits*		Project Quantitation Limit (mg/kg)	Analytical Method – ISM01.3 Quantitation Limits (mg/kg)
		Residential	Non-Residential		
Aluminum	7429-90-5	NS	NS	NS	20
Antimony	7440-36-0	NS	NS	NS	6
Arsenic	7440-38-2	NS	NS	NS	1
Barium	7440-39-3	NS	NS	NS	20
Beryllium	7440-41-7	NS	NS	NS	0.5
Cadmium	7440-43-9	NS	NS	NS	0.5
Calcium	7440-70-2	NS	NS	NS	500
Chromium	7440-47-3	NS	NS	NS	1
Cobalt	7440-48-4	NS	NS	NS	5
Copper	7440-50-8	NS	NS	NS	2.5
Iron	7439-89-6	NS	NS	NS	10
Lead	7439-92-1	NS	NS	NS	1
Magnesium	7439-95-4	NS	NS	NS	500
Manganese	7439-96-5	NS	NS	NS	1.5
Nickel	7440-02-0	NS	NS	NS	4
Potassium	7440-09-7	NS	NS	NS	500
Selenium	7782-49-2	NS	NS	NS	3.5
Silver	7440-22-4	NS	NS	NS	1
Sodium	7440-23-5	NS	NS	NS	500
Thallium	7440-28-0	NS	NS	NS	2.5
Vanadium	7440-62-2	NS	NS	NS	5
Zinc	7440-66-6	NS	NS	NS	6
Tin	7440-31-5	NS	NS	NS	5.0

**QAPP Worksheet #15: Reference Limits and Evaluation Table**  
**QAPP Worksheet #15A: Aqueous – TAL Metals**

**Matrix:** Aqueous (Rinsate Blanks)  
**Analytical Group:** Target Analyte List Inorganics (ICP-AES)  
**Concentration Level:** Low – ICP-AES

Analyte	CAS Number	Project Action Limits*	Project Quantitation Limit (ug/L)	Analytical Method – ISM01.3 ICP-AES Quantitation Limits (ug/L)
Aluminum	7429-90-5	NS	NS	200
Antimony	7440-36-0	NS	NS	60
Arsenic	7440-38-2	NS	NS	10
Barium	7440-39-3	NS	NS	200
Beryllium	7440-41-7	NS	NS	5
Cadmium	7440-43-9	NS	NS	5
Calcium	7440-70-2	NS	NS	5000
Chromium	7440-47-3	NS	NS	10
Cobalt	7440-48-4	NS	NS	50
Copper	7440-50-8	NS	NS	25
Iron	7439-89-6	NS	NS	100
Lead	7439-92-1	NS	NS	10
Magnesium	7439-95-4	NS	NS	5000
Manganese	7439-96-5	NS	NS	15
Nickel	7440-02-0	NS	NS	40
Potassium	2023695	NS	NS	5000
Selenium	7782-49-2	NS	NS	35
Silver	7440-22-4	NS	NS	10
Sodium	7440-23-5	NS	NS	5000
Thallium	7440-28-0	NS	NS	25
Vanadium	7440-62-2	NS	NS	50
Zinc	7440-66-6	NS	NS	60
Tin	7440-31-5	NS	NS	7.0

**QAPP Worksheet #16: Project Schedule/Timeline Table**

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Preparation of QAPP	RST 3 Contractor SPM	Prior to sampling date	7/21/2015	QAPP	7/21/2015
Review of QAPP	RST 3 Contractor QAO and/or Group Leader	Prior to sampling date	7/22/2015	Approved QAPP	7/23/2015
Preparation of HASP	RST 3 Contractor SPM	Prior to sampling date	7/17/2015	HASP	7/17/2015
Procurement of Field Equipment	RST 3 Contractor SPM and/or Equipment Officer	Prior to sampling date	7/30/2015	NA	--
Laboratory Request	Not Applicable	Prior to sampling date	7/23/2015	Analytical Request Form	--
Field Reconnaissance/Access	RST 3 Contractor SPM; or EPA Region II OSC	NA	NA	NA	--
Collection of Field Samples	RST 3 Contractor SPM	8/3/2015	8/7/2015	NA	--
Laboratory Electronic Data Received	RST 3 Contractor	21 days from sampling date	8/28/2015	Preliminary Data	8/28/2015
Laboratory Package Received	RST 3 Contractor	21 days from sampling dates	8/28/2015	--	--
Validation of Laboratory Results	RST 3 Contractor	42 days from sampling dates	8/28/2015	Validation Report	9/18/2015
Data Evaluation/ Preparation of Final Report	RST 3 Contractor SPM	2 weeks from validated data	9/18/2015	Analytical Report	10/2/2015



## **QAPP Worksheet #17: Sampling Design and Rationale**

As part of the Removal Assessment, Weston Solutions, Inc., RST 3 is has been tasked with conducting an on-site assessment at the former Lake Erie Smelting Site at 440 Clinton Street, Buffalo, New York (currently occupied by Towne Garden apartments). Tasks to include collecting soil samples at depth (0-1", 1-6", 6-12", 12-18", and 18-24" intervals) at 52 locations, field screening all samples via X-Ray Fluorescence (XRF) analyzer for lead, and submitting up to 30 percent of the samples for laboratory analysis for TAL Metals including tin (Sn). Additional sampling may be collected as directed by the OSC. The soil samples will be collected for a definitive data QA Objective. Field duplicate and Matrix Spike/Matrix Spike Duplicate (MS/MSD) soil samples will be collected at a frequency of one per 20 samples. A rinsate blank sample will be collected on each day of soil sampling activities to demonstrate adequate decontamination of non-dedicated sampling devices (*i.e.* hand augers and shovels). RST 3 is to document the field event through photos and a daily log book for the estimated one week of Site activities. Identifying subsurface utilities may be necessary.

### **SOIL SAMPLING**

Soil sampling will be conducted as per EPA/ERT Standard Operating Procedure (SOP) 2001 for General Field Sampling Guidelines and SOP 2012 for Soil Sampling from the Compendium of ERT Soil Sampling and Surface Geophysics Procedures

The soil samples will be collected for a definitive data QA Objective. Field duplicate and MS/MSD samples will be collected at a rate of one per 30 per matrix for soil sampling, and one rinsate blank sample will be collected daily to demonstrate adequate decontamination of non-dedicated sampling devices (*i.e.* hand augers) as requested by the lab. All sample information will be entered into a Scribe database for the generation of the chain of custody and sample labels.

All stainless-steel equipment used during field-sampling activities will be decontaminated in accordance to EPA/ERT SOP #2006 prior to and subsequent to sampling. Decontamination of sampling equipment will be conducted as follows:

1. Alconox detergent and potable water scrub.
2. Potable water rinse.
3. Deionized water rinse.
4. Air dry (sufficient time will be allowed for the equipment to completely dry)
5. Deionized water rinse and air dry.

**QAPP Worksheet #17: Sampling Design and Rationale (Concluded)**

The following laboratory will provide the analyses indicated:

Lab Name/Location	Sample Type	Parameters
To Be Determined	Soil and Aqueous	TAL Metals + Sn

Refer to Worksheet #20 for QA/QC samples, sampling methods, and SOPs.

### QAPP Worksheet #18: Sampling Locations and Methods/SOP Requirements Table

Matrix	Sampling Location(s)	Units	Analytical Group(s)	Concentration Level	No. of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
Soil	52	mg/kg	TAL Metals + Sn	Medium	1/20 duplicate sample per matrix	SOP# 2001, 2006 and 2012	Delineation of soil

The website for EPA-ERT SOPs is: <http://www.ert.org/mainContent.asp?section=Products&subsection=List>

### QAPP Worksheet #19: Analytical SOP Requirements Table

Matrix	No. of Samples	Analytical Group [Lab Assignment]	Concentration Level	Analytical and Preparation Method/SOP Reference	Sample Volume	Containers (number, size, and type)	Preservation Requirements	Maximum Holding Time (preparation/analysis)
Soil	82	TAL Metals (including Sn) [CLP]	Low	ISM01.3	Fill to capacity	(1) 8 oz. glass jar w/Teflon lined cap	Cool to 4°C	180 days
Aqueous <sup>1</sup>	4	TAL Metals (including Sn) [CLP]	Low	ISM01.3	1000 ml	(1) 1 L HDPE bottle	HNO <sub>3</sub> to pH<2; cool to 4°C	180 days

<sup>1</sup> Aqueous samples are rinsate samples only. Aqueous field duplicate and MS/MSD samples will not be collected.  
Note: Additional sample volume will be collected for MS/MSD analysis.

**QAPP Worksheet #20: Field Quality Control Sample Summary Table**

<b>Matrix</b>	<b>Analytical Group</b>	<b>Concentration Level</b>	<b>Analytical and Preparation SOP Reference</b>	<b>No. of Sampling Locations</b>	<b>No. of Field Duplicate Pairs</b>	<b>No. of Extra Volume Laboratory QC (e.g., MS/MSD) Samples<sup>1</sup></b>	<b>No. of Rinsate Blanks<sup>1</sup></b>	<b>No. of Trip. Blanks</b>	<b>No. of PE Samples</b>
Soil	TAL Metals + Sn	Low	CLP Method ISM01.3	52	1 per 20 samples	1 per 20 samples	1 per property or one per day	NR	NR

<sup>1</sup> Only required if non-dedicated sampling equipment to be used.

NR – not required

TAL – target analyte list

**QAPP Worksheet #21: Project Sampling SOP References Table**

<b>Reference Number</b>	<b>Title, Revision Date and/or Number</b>	<b>Originating Organization</b>	<b>Equipment Type</b>	<b>Modified for Project Work? (Y/N)</b>	<b>Comments</b>
<u>SOP #2012</u>	Soil Sampling from the Compendium of ERT Soil Sampling and Surface Geophysics Procedures.	EPA/OSWER/ERT	Plastic bags, plastic scoops, bucket augers, 8-oz. glass jars	N	--
<u>SOP#2001</u>	General Field Sampling Guidelines (all media); Rev. 0.0 August 1994	EPA/OSWER/ERT	Site Specific	N	--
<u>SOP#2006</u>	Sampling Equipment Decontamination; Rev 0.0 August 1994	EPA/OSWER/ERT	Site Specific	N	--

Note: The website for EPA-ERT SOPs is: [www.ert.org/mainContent.asp?section=Products&subsection=List](http://www.ert.org/mainContent.asp?section=Products&subsection=List)

**QAPP Worksheet #22: Field Equipment Calibration, Maintenance, Testing, and Inspection Table**

Field Equipment	Calibration Activity	Maintenance Activity	Testing/ Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Trimble® GeoXT™ handheld								

**QAPP Worksheet #23: Analytical SOP References Table**

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
ISM01.3	USEPA Contract Laboratory Program Statement of Work for Multi-Media, Multi-Concentration Inorganic Analysis,; December 2006	Definitive	Target Analyte List Metals + Sn	ICP-AES / ICP-MS	CLP RAS Laboratory	N

ICP-AES – Inductively coupled plasma – atomic emission spectroscopy  
USEPA – U.S. Environmental Protection Agency

### QAPP Worksheet #24: Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference <sup>1</sup>
ICP-AES	See ISM01.3 ; as per instrument manufacturer's recommended procedures	ICP-AES Initial calibration: daily or once every 24 hours and each time the instrument is set up. ICP-AES Continuing calibration: beginning and end of run, and frequency of 10% or every 2 hours during an analysis run.	ICP-AES: As per instrument manufacturer's recommended procedures, with at least 2 standards.	ICP-AES: inspect the system, correct problem, re-calibrate, re-analyze samples.	EPA CLP RAS Laboratory ICP-AES Technician	ISM01.3

<sup>1</sup> Specify the appropriate letter or number form the Analytical SOP References table (Worksheet #23)

EPA – U.S. Environmental Protection Agency

ICP-AES – inductively coupled plasma atomic emission spectroscopy

SOP – standard operating procedure

### QAPP Worksheet #25: Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing/Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference <sup>1</sup>
ICP-AES	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations; check connections	As per instrument manufacturer's recommendations	Acceptable re-calibration; see ISM01.3	Inspect the system, correct problem, re-calibrate and/or reanalyze samples.	EPA CLP RAS Laboratory ICP-AES Technician	ISM01.3

<sup>1</sup> Specify the appropriate letter or number form the Analytical SOP References table (Worksheet #23)

## QAPP Worksheet #26: Sample Handling System

<b>SAMPLE COLLECTION, PACKAGING, AND SHIPMENT</b>
<b>Sample Collection (Personnel/Organization):</b> RST 3 Site Project Manager, Weston Solutions, Inc., Region II
<b>Sample Packaging (Personnel/Organization):</b> RST 3 Site Project Manager and sampling team members, Weston Solutions, Inc., Region II
<b>Coordination of Shipment (Personnel/Organization):</b> RST 3 Site Project Manager, sampling team members, Weston Solutions, Inc., Region II
<b>Type of Shipment/Carrier:</b> Hand-delivery or FedEx
<b>SAMPLE RECEIPT AND ANALYSIS</b>
<b>Sample Receipt (Personnel/Organization):</b> CLP-RAS Laboratory, Sample Custodian
<b>Sample Custody and Storage (Personnel/Organization):</b> CLP-RAS Laboratory, Sample Custodian
<b>Sample Preparation (Personnel/Organization):</b> CLP-RAS Laboratory, Sample Custodian
<b>Sample Determinative Analysis (Personnel/Organization):</b> CLP-RAS Laboratory, Sample Custodian
<b>SAMPLE ARCHIVING</b>
<b>Field Sample Storage (No. of days from sample collection):</b> Samples to be shipped same day of collection, and arrive at laboratory within 24 hours (1 day) of sample shipment
<b>Sample Extract/Digestate Storage (No. of days from extraction/digestion):</b> As per analytical methodology; see Worksheet #19
<b>SAMPLE DISPOSAL</b>
<b>Personnel/Organization:</b> CLP-RAS Laboratory, Sample Custodian
<b>Number of Days from Analysis:</b> Until analysis and QA/QC checks are completed; as per analytical methodology; see Worksheet #19.



### QAPP Worksheet #27: Sample Custody Requirements

**Sample Identification Procedures:** Each sample collected by Region II RST 3 will be designated by a code that will identify the site. The code will be a site-specific property number. The media type will follow the numeric code. A hyphen will separate the site code and media type. Specific media types are as follows: SS – Soil Sample RB – Rinsate Blank

After the media type, the sequential sample numbers will be listed; duplicate samples will be identified in the same manner as other samples and will be distinguished and documented in the field logbook.

e.g. P001-SS001-0612-001 Property P001, Soil Sample Number 001, 6 to 12 Inches in Depth, First Sample From Location.  
RB-051415 RB- Rinsate Blank, Date 051415.

**Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory):** Each sample will be individually identified and labeled after collection, then sealed with custody seals and enclosed in a plastic cooler. The sample information will be recorded on chain-of custody (COC) forms, and will be either hand delivered or shipped to the appropriate laboratory via overnight delivery service or courier. Chain-of-custody records must be prepared in Scribe to accompany samples from the time of collection and throughout the shipping process. Each individual in possession of the samples must sign and date the sample COC Record. The chain-of-custody record will be considered completed upon receipt at the laboratory. A traffic report and chain-of-custody record will be maintained from the time the sample is taken to its final deposition. Every transfer of custody must be noted and signed for, and a copy of this record kept by each individual who has signed. When samples are not under direct control of the individual responsible for them, they must be stored in a locked container sealed with a custody seal. Specific information regarding custody of the samples projected to be collected on the weekend will be noted in the field logbook. The chain-of-custody record should include (at minimum) the following: 1) Sample identification number; 2) Sample information; 3) Sample location; 4) Sample date; 5) Sample Time; 6) Sample Type Matrix; 7) Sample Container Type; 8) Sample Analysis Requested; 9) Name(s) and signature(s) of sampler(s); and 10) Signature(s) of any individual(s) with custody of samples.

**For this event each parcel will have its own chain-of custody.** A separate chain-of-custody form must accompany each cooler for each daily shipment. The chain-of-custody form must address all samples in that cooler, but not address samples in any other cooler. This practice maintains the chain-of-custody for all samples in case of mis-shipment.

**Laboratory Sample Custody Procedures (receipt of samples, archiving, and disposal):** A sample custodian at the laboratory will accept custody of the shipped samples, and check them for discrepancies, proper preservation, integrity, etc. If noted, issues will be forwarded to the laboratory manager for corrective action. The sample custodian will relinquish custody to the appropriate department for analysis. At this time, no samples will be archived at the laboratory. Disposal of the samples will occur only after analyses and QA/QC checks are completed.

## QAPP Worksheet #28: QC Samples Table

### (UFP-QAPP Manual Section 3.4)

Complete a separate worksheet for each sampling technique, analytical method/SOP, matrix, analytical group, and concentration level. If method/SOP QC acceptance limit exceed the measurement performance criteria, the data obtained may be unusable for making project decisions.

Matrix	Soil/ Aqueous <sup>1</sup>
Analytical Group	TAL Metals + Sn
Concentration Level	Low/Medium
Sampling SOP	EPA ERT SOP #2012
Analytical Method/ SOP Reference	ISM01.3
Sampler's Name	RST 3
Field Sampling Organization	Weston Solutions, Inc. RST 3
Analytical Organization	EPA CLP RAS Laboratory
No. of Sample Locations	52

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Preparation Blank	1 per ≤ 20 samples	No constituent > CRQL	Suspend analysis until source rectified; redigest and reanalyze affected samples	EPA CLP RAS Laboratory ICP-AES Technician	Accuracy	No constituent > CRQL
Spike	1 per ≤ 20 samples	75-125%R*	Flag outliers	EPA CLP RAS Laboratory ICP-AES Technician	Accuracy	75-125%R*
Duplicate	1 per ≤ 20 samples	± 20% RPD**	Flag outliers	EPA CLP RAS Laboratory ICP-AES Technician	Precision	± 20% RPD**
Post-Digestion Spike	after any analyte (except Ag) fails spike %R	75-125%R	Flag outliers	EPA CLP RAS Laboratory ICP-AES Technician	Accuracy	75-125%R
Interference Check Sample [ICP Analysis Only]	beginning of each run	Within ± (CRQL + true value) or ± 20% of true value, whichever is greater	Check calculations and instruments, reanalyze affected samples	EPA CLP RAS Laboratory ICP-AES Technician	Sensitivity	Within ± (CRQL + true value) or ± 20% of true value, whichever is greater

<sup>1</sup>Aqueous samples will consist of rinsate blank samples only. Aqueous field duplicate and MS/MSD samples will not be collected.

\*except when the sample concentration is greater than 4 times the spike concentration, then disregard the recoveries; no data validation action taken

\*\*except when the sample and/or duplicate concentration is less than 5 times the CRQL, then ± CRQL.

### QAPP Worksheet #28: QC Samples Table (Concluded)

#### (UFP-QAPP Manual Section 3.4)

Complete a separate worksheet for each sampling technique, analytical method/SOP, matrix, analytical group, and concentration level. If method/SOP QC acceptance limit exceed the measurement performance criteria, the data obtained may be unusable for making project decisions.

Matrix	Soil/ Aqueous <sup>1</sup>					
Analytical Group	TAL Metals + Sn					
Concentration Level	Low/Medium					
Sampling SOP	EPA ERT SOP #2012					
Analytical Method/ SOP Reference	ISM01.3					
Sampler's Name	RST 3					
Field Sampling Organization	Weston Solutions, Inc. RST 3					
Analytical Organization	EPA CLP RAS Laboratory					
No. of Sample Locations	52					
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Laboratory Control Sample	1 per ≤ 20 samples	70-130%R	Suspend analysis until source rectified; redigest and reanalyze affected samples	EPA CLP RAS Laboratory ICP-AES Technician	Accuracy	70-130%R

<sup>1</sup>Aqueous samples will consist of rinsate blank samples only. Aqueous field duplicate and MS/MSD samples will not be collected.

### QAPP Worksheet #29: Project Documents and Records Table

Sample Collection Documents and Records	Analysis Documents and Records	Data Assessment Documents and Records	Other
<ul style="list-style-type: none"> <li>• Field logbooks</li> <li>• COC forms</li> <li>• Field Data Sheets</li> <li>• Photo-document</li> <li>• CLP sample numbers</li> </ul>	<ul style="list-style-type: none"> <li>• Sample receipt logs</li> <li>• Internal and external COC forms</li> <li>• Equipment calibration logs</li> <li>• Sample preparation worksheets/logs</li> <li>• Sample analysis worksheets/run logs</li> <li>• Telephone/email logs</li> <li>• Corrective action documentation</li> </ul>	<ul style="list-style-type: none"> <li>• Data validation reports</li> <li>• Field inspection checklist(s)</li> <li>• Review forms for electronic entry of data into database</li> <li>• Corrective action documentation</li> </ul>	CLP Request Form

### QAPP Worksheet #30: Analytical Services Table

Matrix	Analytical Group	Concentration Level	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number)
Soil	TAL Metals + Sn	Medium	CLP Method ISM01.3	21 days preliminary	CLP-RAS Laboratory TBD	NA

NA – not applicable  
SOP – standard operating procedure  
TAL – target analyte list

**QAPP Worksheet #31: Planned Project Assessments Table**

<b>Assessment Type</b>	<b>Frequency</b>	<b>Internal or External</b>	<b>Organization Performing Assessment</b>	<b>Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)</b>	<b>Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)</b>	<b>Person(s) Responsible for Identifying and Implementing Corrective Actions (Title and Organizational Affiliation)</b>	<b>Person(s) Responsible for Monitoring Effectiveness of Corrective Actions (Title and Organizational Affiliation)</b>
Laboratory Technical Systems	Every Year	External	Regulatory Agency	Regulatory Agency	EPA CLP RAS Laboratory	EPA CLP RAS Laboratory	EPA or other Regulatory Agency
Performance Evaluation Samples**	--	External	Regulatory Agency	Regulatory Agency	EPA CLP RAS Laboratory	EPA CLP RAS Laboratory	EPA or other Regulatory Agency
Peer Review	Each Deliverable	Internal	Weston Solutions, Inc.	QAO, Group Leader, and Readiness Coordinator	SPM, Weston Solutions, Inc.	SPM, Weston Solutions, Inc.	EPA OSC and/or EPA QAO

**QAPP Worksheet #32: Assessment Findings and Corrective Action Responses**

<b>Assessment Type</b>	<b>Nature of Deficiencies Documentation</b>	<b>Individual(s) Notified of Findings (Name, Title, Organization)</b>	<b>Timeframe of Notification</b>	<b>Nature of Corrective Action Response Documentation</b>	<b>Individual(s) Receiving Corrective Action Response (Name, Title, Org.)</b>	<b>Timeframe for Response</b>
Project Readiness Review	Checklist or logbook entry	RST 3 Site Project Manager, Weston Solutions, Inc.	Immediately to within 24 hours of review	Checklist or logbook entry	RST 3 Site Project Leader	Immediately to within 24 hours of review
Field Observations/ Deviations from Work Plan	Logbook	RST 3 Site Project Manager, Weston Solutions, Inc. and EPA OSC	Immediately to within 24 hours of deviation	Logbook	RST 3 Site Project Manager and EPA OSC	Immediately to within 24 hours of deviation
Proficiency Testing	Letter with PT failure indicated	Lab QA Officer	30 days after the audit	Investigate the reason for the PT failure	Lab QA Officer	45 days after the CA report
NELAC	Audit Report with Non-conformance to QAPP, SOPs, NELAC+LQMP	Lab Management	30 days after the audit	Investigate and have a corrective action plan for the deficiencies	Florida DOH	30 days after receiving notification
Internal	Audit Report with Non-conformance to QAPP, SOPs, NELAC Regulations	Lab Management	30 days after the audit	Investigate and have a corrective action plan for the deficiencies	Lab QA Officer	45 days after the CA report

**QAPP Worksheet #33: QA Management Reports Table**

<b>Type of Report</b>	<b>Frequency (Daily, weekly, monthly, quarterly, annually, etc.)</b>	<b>Projected Delivery Date(s)</b>	<b>Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)</b>	<b>Report Recipient(s) (Title and Organizational Affiliation)</b>
EPA CLP RAS Laboratory (preliminary)	As performed	3 weeks from the sampling date	EPA CLP RAS Laboratory	Adly Michael, RSCC, EPA Region 2 and contractor, RST 3 SPM, Weston Solutions, Inc., and OSC, EPA Region II
EPA CLP RAS Laboratory (validated)	As performed	Up to 21 days after receipt of preliminary data	EPA Region II Data Validator	RST 3 SPM, Weston Solutions, Inc., and OSC, EPA Region II
On-Site Field Inspection	As performed	7 calendar days after completion of the inspection	RST 3 HSO	RST 2 SPM, Weston Solutions, Inc.
Field Change Request	As required per field change	3 days after identification of need for field change	RST 3 SPM	EPA OSC
Final Report	As performed	2 weeks after receipt of EPA approval of data package	RST 3 SPM	EPA OSC

**QAPP Worksheet #34: Verification (Step I) Process Table**

<b>Verification Input</b>	<b>Description</b>	<b>Internal/ External</b>	<b>Responsible for Verification (Name, Organization)</b>
Site/field logbooks	Field notes will be prepared daily by the RST 3 Site Project Manager and will be complete, appropriate, legible and pertinent. Upon completion of field work, logbooks will be placed in the project files.	I	RST 3 Site Project Manager
Chains of custody	COC forms will be reviewed against the samples packed in the specific cooler prior to shipment. The reviewer will initial the form. An original COC will be sent with the samples to the laboratory, while copies are retained for (1) the Sampling Trip Report and (2) the project files.	I	RST 3 Site Project Manager
Sampling Trip Reports	STRs will be prepared for each week of field sampling. Information in the STR will be reviewed against the COC forms, and potential discrepancies will be discussed with field personnel to verify locations, dates, etc.	I	RST 3 Site Project Manager
Laboratory analytical data package	Data packages will be reviewed/verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal.	E	EPA Region 2 Procured CLP-RAS Laboratory
Laboratory analytical data package	Data packages will be reviewed as to content and sample information upon receipt by EPA.	I	RST 3 Site Project Manager
Final Sample Report	The project data results will be compiled in a sample report for the project. Entries will be reviewed/verified against hardcopy information.	I	RST 3 Site Project Manager



**QAPP Worksheet #35: Validation (Steps IIa and IIb) Process Table**

<b>Step IIa/IIb</b>	<b>Validation Input</b>	<b>Description</b>	<b>Responsible for Validation (Name, Organization)</b>
IIa	SOPs	Ensure that the sampling methods/procedures outlined in QAPP were followed, and that any deviations were noted/approved.	Site Project Manager, Weston Solutions, Inc.
IIb	SOPs	Determine potential impacts from noted/approved deviations, in regard to PQOs.	Site Project Manager, Weston Solutions, Inc.
IIa	Chains of custody	Examine COC forms against QAPP and laboratory contract requirements (e.g., analytical methods, sample identification, etc.).	EPA Region 2 Data Validation Personnel with contractor support
IIa	Laboratory data package	Examine packages against QAPP and laboratory contract requirements, and against COC forms (e.g., holding times, sample handling, analytical methods, sample identification, data qualifiers, QC samples, etc.).	EPA Region 2 Data Validation Personnel with contractor support
IIb	Laboratory data package	Determine potential impacts from noted/approved deviations, in regard to PQOs. Examples include PQLs and QC sample limits (precision/accuracy).	EPA Region 2 Data Validation Personnel with contractor support, Contractor Project Leader
IIb	Field duplicates	Compare results of field duplicate (or replicate) analyses with RPD criteria	Site Project Manager, Weston Solutions, Inc.

**QAPP Worksheet #36: Validation (Steps IIa and IIb) Summary Table**

<b>Step IIa/IIb</b>	<b>Matrix</b>	<b>Analytical Group</b>	<b>Concentration Level</b>	<b>Validation Criteria</b>	<b>Data Validator (title and organizational affiliation)</b>
IIa / IIb	Soil/Aqueous	TAL Metals + Sn	Medium	Inorganic analysis of low/medium concentration metals under SOW ISM01.3; SOP HW-29, Rev-15	EPA ESAT Data Validation Personnel

### QAPP Worksheet #37: Usability Assessment

**Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:** Data, whether generated in the field or by the laboratory, are tabulated and reviewed for Precision, Accuracy, Representativeness, Completeness, and Comparability (PARCCS) by the SPM for field data or the data validator for laboratory data. The review of the PARCC DQIs will compare with the DQO detailed in the Final Site-Specific QAPP, the analytical methods used and impact of any qualitative and quantitative trends will be examined to determine if bias exists. A hard copy of field data is maintained in a designated field or site logbook. Laboratory data packages are validated, and final data reports are generated. All documents and logbooks are assigned unique and specific control numbers to allow tracking and management. Questions about Non-CLP data, as observed during the data review process, are resolved by contacting the respective site personnel and laboratories as appropriate for resolution. All communications are documented in the data validation record with comments as to the resolution to the observed deficiencies.

Where applicable, the following documents will be followed to evaluate data for fitness in decision making: EPA QA/G-4, *Guidance on Systematic Planning using the Data Quality Objectives Process*, EPA/240/B-06/001, February 2006, and EPA QA/G-9R, *Guidance for Data Quality Assessment*, A reviewer's Guide EPA/240/B-06/002, February 2006.

**Describe the evaluative procedures used to assess overall measurement error associated with the project:**

As delineated in the *Uniform Federal Policy for Implementing Environmental Quality Systems: Evaluating, Assessing and Documenting Environmental Data Collection and Use Programs Part 1: UFP-QAPP (EPA-505-B-04-900A, March 2005); Part 2A: UFP-QAPP Workbook (EPA-505-B-04-900C, March 2005); Part 2B: Quality Assurance/Quality Control Compendium: Non-Time Critical QA/QC Activities (EPA-505-B-04-900B, March 2005)*; "Graded Approach" will be implemented for data collection activities that are either exploratory or where specific decisions cannot be identified, since this guidance indicates that the formal DQO process is not necessary.

The data will be evaluated to determine whether they satisfy the PQO for the project. The validation process determines if the data satisfy the QA criteria. After the data pass the data validation process, comparison results with the PQO is done. Based on results from the above described assessment, a follow-up risk based assessment may be required for both on-site (Towne Garden complex) and the surrounding residential neighborhood. Following EPA's Superfund Lead-Contaminated Residential Sites Handbook (August 2003), the Towne Garden complex would be divided into quarter-acre quadrants and five point composite samples would be collected from each quadrant for XRF screening and up to 30-percent confirmation laboratory analysis. Residential parcels would be divided into quadrants based on property configuration and sampled for XRF screening and 20-percent confirmation laboratory analysis. EPA will use this analytical data to evaluate if soil analysis exceeds EPA's RML's and extent of on-site soil contamination.

**QAPP Worksheet #37: Usability Assessment (Concluded)**

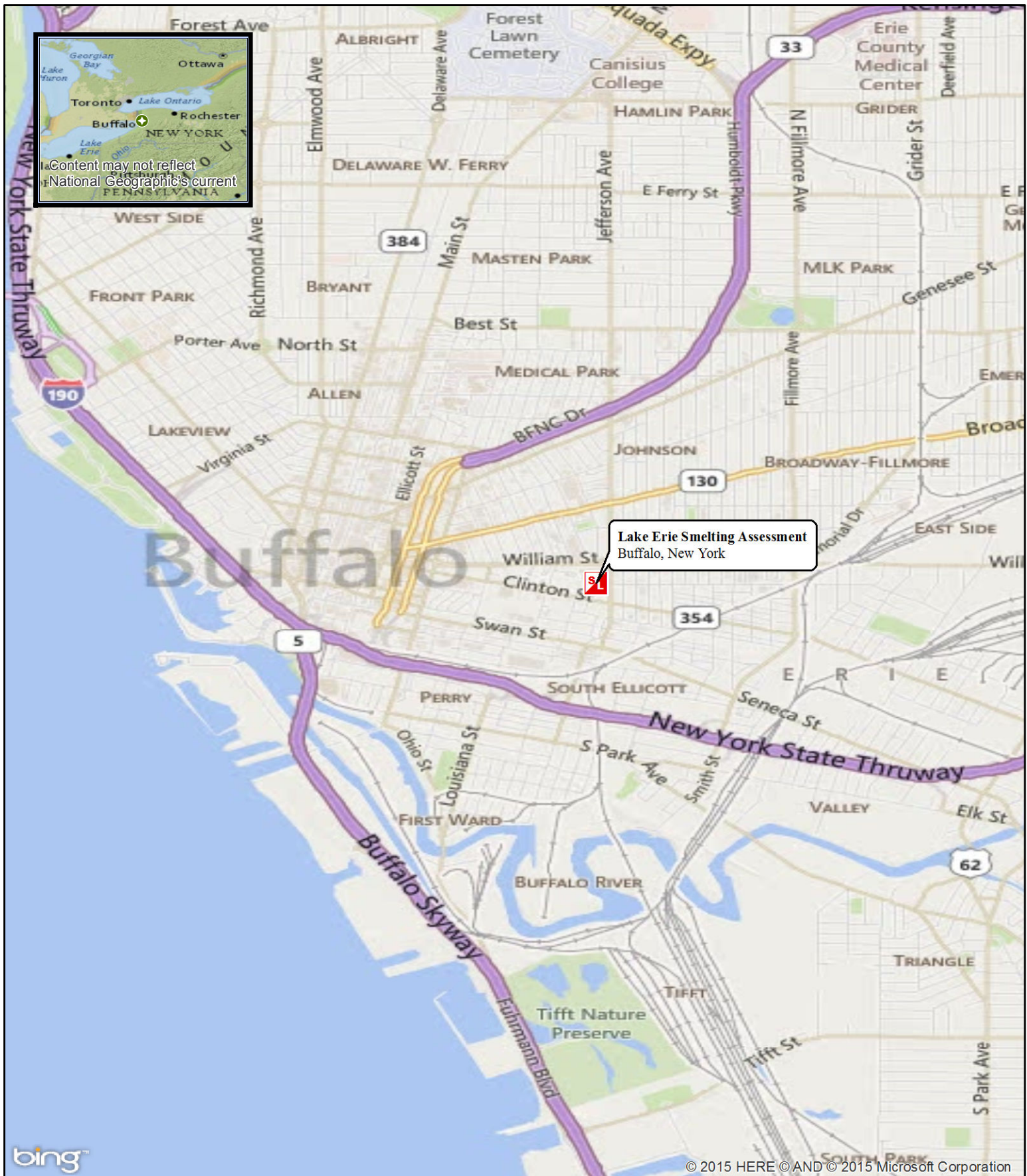
**Identify the personnel responsible for performing the usability assessment:** SPM, Data Validation Personnel, and EPA, Region II  
OSC

**Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:**

A copy of the most current approved QAPP, including any graphs, maps and text reports developed will be provided to all personnel identified on the distribution list.

## **ATTACHMENT A**

### **Site Location Map**



## **ATTACHMENT B**

### **Sampling SOPs**

**EPA/ERT SOP # 2001**

**EPA/ERT SOP # 2006**

**EPA/ERT SOP # 2012**



# GENERAL FIELD SAMPLING GUIDELINES

SOP#: 2001  
DATE: 08/11/94  
REV. #: 0.0

## 1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to provide general field sampling guidelines that will assist REAC personnel in choosing sampling strategies, location, and frequency for proper assessment of site characteristics. This SOP is applicable to all field activities that involve sampling.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent on site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. EPA endorsement or recommendation for use.

## 2.0 METHOD SUMMARY

Sampling is the selection of a representative portion of a larger population, universe, or body. Through examination of a sample, the characteristics of the larger body from which the sample was drawn can be inferred. In this manner, sampling can be a valuable tool for determining the presence, type, and extent of contamination by hazardous substances in the environment.

The primary objective of all sampling activities is to characterize a hazardous waste site accurately so that its impact on human health and the environment can be properly evaluated. It is only through sampling and analysis that site hazards can be measured and the job of cleanup and restoration can be accomplished effectively with minimal risk. The sampling itself must be conducted so that every sample collected retains its original physical form and chemical composition. In this way, sample integrity is insured, quality assurance standards are maintained, and the sample can accurately represent the larger body of

material under investigation.

The extent to which valid inferences can be drawn from a sample depends on the degree to which the sampling effort conforms to the project's objectives. For example, as few as one sample may produce adequate, technically valid data to address the project's objectives. Meeting the project's objectives requires thorough planning of sampling activities, and implementation of the most appropriate sampling and analytical procedures. These issues will be discussed in this procedure.

## 3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

The amount of sample to be collected, and the proper sample container type (i.e., glass, plastic), chemical preservation, and storage requirements are dependent on the matrix being sampled and the parameter(s) of interest. Sample preservation, containers, handling, and storage for air and waste samples are discussed in the specific SOPs for air and waste sampling techniques.

## 4.0 INTERFERENCES AND POTENTIAL PROBLEMS

The nature of the object or materials being sampled may be a potential problem to the sampler. If a material is homogeneous, it will generally have a uniform composition throughout. In this case, any sample increment can be considered representative of the material. On the other hand, heterogeneous samples present problems to the sampler because of changes in the material over distance, both laterally and vertically.

Samples of hazardous materials may pose a safety threat to both field and laboratory personnel. Proper health and safety precautions should be implemented when handling this type of sample.



Environmental conditions, weather conditions, or non-target chemicals may cause problems and/or interferences when performing sampling activities or when sampling for a specific parameter. Refer to the specific SOPs for sampling techniques.

## **5.0 EQUIPMENT/APPARATUS**

The equipment/apparatus required to collect samples must be determined on a site specific basis. Due to the wide variety of sampling equipment available, refer to the specific SOPs for sampling techniques which include lists of the equipment/apparatus required for sampling.

## **6.0 REAGENTS**

Reagents may be utilized for preservation of samples and for decontamination of sampling equipment. The preservatives required are specified by the analysis to be performed. Decontamination solutions are specified in ERT SOP #2006, Sampling Equipment Decontamination.

## **7.0 PROCEDURE**

### **7.1 Types of Samples**

In relation to the media to be sampled, two basic types of samples can be considered: the environmental sample and the hazardous sample.

Environmental samples are those collected from streams, ponds, lakes, wells, and are off-site samples that are not expected to be contaminated with hazardous materials. They usually do not require the special handling procedures typically used for concentrated wastes. However, in certain instances, environmental samples can contain elevated concentrations of pollutants and in such cases would have to be handled as hazardous samples.

Hazardous or concentrated samples are those collected from drums, tanks, lagoons, pits, waste piles, fresh spills, or areas previously identified as contaminated, and require special handling procedures because of their potential toxicity or hazard. These samples can be further subdivided based on their degree of hazard; however, care should be taken when handling and shipping any wastes believed to be concentrated regardless of the degree.

The importance of making the distinction between environmental and hazardous samples is two-fold:

- (1) Personnel safety requirements: Any sample thought to contain enough hazardous materials to pose a safety threat should be designated as hazardous and handled in a manner which ensures the safety of both field and laboratory personnel.
- (2) Transportation requirements: Hazardous samples must be packaged, labeled, and shipped according to the International Air Transport Association (IATA) Dangerous Goods Regulations or Department of Transportation (DOT) regulations and U.S. EPA guidelines.

### **7.2 Sample Collection Techniques**

In general, two basic types of sample collection techniques are recognized, both of which can be used for either environmental or hazardous samples.

#### Grab Samples

A grab sample is defined as a discrete aliquot representative of a specific location at a given point in time. The sample is collected all at once at one particular point in the sample medium. The representativeness of such samples is defined by the nature of the materials being sampled. In general, as sources vary over time and distance, the representativeness of grab samples will decrease.

#### Composite Samples

Composites are nondiscrete samples composed of more than one specific aliquot collected at various sampling locations and/or different points in time. Analysis of this type of sample produces an average value and can in certain instances be used as an alternative to analyzing a number of individual grab samples and calculating an average value. It should be noted, however, that compositing can mask problems by diluting isolated concentrations of some hazardous compounds below detection limits.

Compositing is often used for environmental samples and may be used for hazardous samples under certain conditions. For example, compositing of hazardous waste is often performed after compatibility tests have

been completed to determine an average value over a number of different locations (group of drums). This procedure generates data that can be useful by providing an average concentration within a number of units, can serve to keep analytical costs down, and can provide information useful to transporters and waste disposal operations.

For sampling situations involving hazardous wastes, grab sampling techniques are generally preferred because grab sampling minimizes the amount of time sampling personnel must be in contact with the wastes, reduces risks associated with compositing unknowns, and eliminates chemical changes that might occur due to compositing.

### 7.3 Types of Sampling Strategies

The number of samples that should be collected and analyzed depends on the objective of the investigation. There are three basic sampling strategies: random, systematic, and judgmental sampling.

Random sampling involves collection of samples in a nonsystematic fashion from the entire site or a specific portion of a site. Systematic sampling involves collection of samples based on a grid or a pattern which has been previously established. When judgmental sampling is performed, samples are collected only from the portion(s) of the site most likely to be contaminated. Often, a combination of these strategies is the best approach depending on the type of the suspected/known contamination, the uniformity and size of the site, the level/type of information desired, etc.

### 7.4 QA Work Plans (QAWP)

A QAWP is required when it becomes evident that a field investigation is necessary. It should be initiated in conjunction with, or immediately following, notification of the field investigation. This plan should be clear and concise and should detail the following basic components, with regard to sampling activities:

- C Objective and purpose of the investigation.
- C Basis upon which data will be evaluated.
- C Information known about the site including location, type and size of the facility, and length of operations/abandonment.
- C Type and volume of contaminated material, contaminants of concern (including

concentration), and basis of the information/data.

- C Technical approach including media/matrix to be sampled, sampling equipment to be used, sample equipment decontamination (if necessary), sampling design and rationale, and SOPs or description of the procedure to be implemented.
- C Project management and reporting, schedule, project organization and responsibilities, manpower and cost projections, and required deliverables.
- C QA objectives and protocols including tables summarizing field sampling and QA/QC analysis and objectives.

Note that this list of QAWP components is not all-inclusive and that additional elements may be added or altered depending on the specific requirements of the field investigation. It should also be recognized that although a detailed QAWP is quite important, it may be impractical in some instances. Emergency responses and accidental spills are prime examples of such instances where time might prohibit the development of site-specific QAWPs prior to field activities. In such cases, investigators would have to rely on general guidelines and personal judgment, and the sampling or response plans might simply be a strategy based on preliminary information and finalized on site. In any event, a plan of action should be developed, no matter how concise or informal, to aid investigators in maintaining a logical and consistent order to the implementation of their task.

### 7.5 Legal Implications

The data derived from sampling activities are often introduced as critical evidence during litigation of a hazardous waste site cleanup. Legal issues in which sampling data are important may include cleanup cost recovery, identification of pollution sources and responsible parties, and technical validation of remedial design methodologies. Because of the potential for involvement in legal actions, strict adherence to technical and administrative SOPs is essential during both the development and implementation of sampling activities.

Technically valid sampling begins with thorough planning and continues through the sample collection and analytical procedures. Administrative requirements involve thorough, accurate

documentation of all sampling activities. Documentation requirements include maintenance of a chain of custody, as well as accurate records of field activities and analytical instructions. Failure to observe these procedures fully and consistently may result in data that are questionable, invalid and non-defensible in court, and the consequent loss of enforcement proceedings.

## **8.0 CALCULATIONS**

Refer to the specific SOPs for any calculations which are associated with sampling techniques.

## **9.0 QUALITY ASSURANCE/ QUALITY CONTROL**

Refer to the specific SOPs for the type and frequency of QA/QC samples to be analyzed, the acceptance criteria for the QA/QC samples, and any other QA/QC activities which are associated with sampling techniques.

## **10.0 DATA VALIDATION**

Refer to the specific SOPs for data validation activities that are associated with sampling techniques.

## **11.0 HEALTH AND SAFETY**

When working with potentially hazardous materials, follow U.S. EPA, OSHA, and corporate health and safety procedures.



## **SAMPLING EQUIPMENT DECONTAMINATION**

SOP#: 2006  
DATE: 08/11/94  
REV. #: 0.0

### **1.0 SCOPE AND APPLICATION**

The purpose of this Standard Operating Procedure (SOP) is to provide a description of the methods used for preventing, minimizing, or limiting cross-contamination of samples due to inappropriate or inadequate equipment decontamination and to provide general guidelines for developing decontamination procedures for sampling equipment to be used during hazardous waste operations as per 29 Code of Federal Regulations (CFR) 1910.120. This SOP does not address personnel decontamination.

These are standard (i.e. typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitation, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

### **2.0 METHOD SUMMARY**

Removing or neutralizing contaminants from equipment minimizes the likelihood of sample cross contamination, reduces or eliminates transfer of contaminants to clean areas, and prevents the mixing of incompatible substances.

Gross contamination can be removed by physical decontamination procedures. These abrasive and non-abrasive methods include the use of brushes, air and wet blasting, and high and low pressure water cleaning.

The first step, a soap and water wash, removes all visible particulate matter and residual oils and grease. This may be preceded by a steam or high pressure

water wash to facilitate residuals removal. The second step involves a tap water rinse and a distilled/deionized water rinse to remove the detergent. An acid rinse provides a low pH media for trace metals removal and is included in the decontamination process if metal samples are to be collected. It is followed by another distilled/deionized water rinse. If sample analysis does not include metals, the acid rinse step can be omitted. Next, a high purity solvent rinse is performed for trace organics removal if organics are a concern at the site. Typical solvents used for removal of organic contaminants include acetone, hexane, or water. Acetone is typically chosen because it is an excellent solvent, miscible in water, and not a target analyte on the Priority Pollutant List. If acetone is known to be a contaminant of concern at a given site or if Target Compound List analysis (which includes acetone) is to be performed, another solvent may be substituted. The solvent must be allowed to evaporate completely and then a final distilled/deionized water rinse is performed. This rinse removes any residual traces of the solvent.

The decontamination procedure described above may be summarized as follows:

1. Physical removal
2. Non-phosphate detergent wash
3. Tap water rinse
4. Distilled/deionized water rinse
5. 10% nitric acid rinse
6. Distilled/deionized water rinse
7. Solvent rinse (pesticide grade)
8. Air dry
9. Distilled/deionized water rinse

If a particular contaminant fraction is not present at the site, the nine (9) step decontamination procedure specified above may be modified for site specificity. For example, the nitric acid rinse may be eliminated if metals are not of concern at a site. Similarly, the solvent rinse may be eliminated if organics are not of

concern at a site. Modifications to the standard procedure should be documented in the site specific work plan or subsequent report.

### **3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE**

The amount of sample to be collected and the proper sample container type (i.e., glass, plastic), chemical preservation, and storage requirements are dependent on the matrix being sampled and the parameter(s) of interest.

More specifically, sample collection and analysis of decontamination waste may be required before beginning proper disposal of decontamination liquids and solids generated at a site. This should be determined prior to initiation of site activities.

### **4.0 INTERFERENCES AND POTENTIAL PROBLEMS**

- C The use of distilled/deionized water commonly available from commercial vendors may be acceptable for decontamination of sampling equipment provided that it has been verified by laboratory analysis to be analyte free (specifically for the contaminants of concern).
- C The use of an untreated potable water supply is not an acceptable substitute for tap water. Tap water may be used from any municipal or industrial water treatment system.
- C If acids or solvents are utilized in decontamination they raise health and safety, and waste disposal concerns.
- C Damage can be incurred by acid and solvent washing of complex and sophisticated sampling equipment.

### **5.0 EQUIPMENT/APPARATUS**

Decontamination equipment, materials, and supplies are generally selected based on availability. Other considerations include the ease of decontaminating or disposing of the equipment. Most equipment and supplies can be easily procured. For example, soft-

bristle scrub brushes or long-handled bottle brushes can be used to remove contaminants. Large galvanized wash tubs, stock tanks, or buckets can hold wash and rinse solutions. Children's wading pools can also be used. Large plastic garbage cans or other similar containers lined with plastic bags can help segregate contaminated equipment. Contaminated liquid can be stored temporarily in metal or plastic cans or drums.

The following standard materials and equipment are recommended for decontamination activities:

#### **5.1 Decontamination Solutions**

- C Non-phosphate detergent
- C Selected solvents (acetone, hexane, nitric acid, etc.)
- C Tap water
- C Distilled or deionized water

#### **5.2 Decontamination Tools/Supplies**

- C Long and short handled brushes
- C Bottle brushes
- C Drop cloth/plastic sheeting
- C Paper towels
- C Plastic or galvanized tubs or buckets
- C Pressurized sprayers (H<sub>2</sub>O)
- C Solvent sprayers
- C Aluminum foil

#### **5.3 Health and Safety Equipment**

Appropriate personal protective equipment (i.e., safety glasses or splash shield, appropriate gloves, aprons or coveralls, respirator, emergency eye wash)

#### **5.4 Waste Disposal**

- C Trash bags
- C Trash containers
- C 55-gallon drums
- C Metal/plastic buckets/containers for storage and disposal of decontamination solutions

### **6.0 REAGENTS**

There are no reagents used in this procedure aside from the actual decontamination solutions. Table 1 (Appendix A) lists solvent rinses which may be required for elimination of particular chemicals. In

general, the following solvents are typically utilized for decontamination purposes:

- C 10% nitric acid is typically used for inorganic compounds such as metals. An acid rinse may not be required if inorganics are not a contaminant of concern.
- C Acetone (pesticide grade)<sup>(1)</sup>
- C Hexane (pesticide grade)<sup>(1)</sup>
- C Methanol<sup>(1)</sup>

<sup>(1)</sup> - Only if sample is to be analyzed for organics.

## 7.0 PROCEDURES

As part of the health and safety plan, a decontamination plan should be developed and reviewed. The decontamination line should be set up before any personnel or equipment enter the areas of potential exposure. The equipment decontamination plan should include:

- C The number, location, and layout of decontamination stations.
- C Decontamination equipment needed.
- C Appropriate decontamination methods.
- C Methods for disposal of contaminated clothing, equipment, and solutions.
- C Procedures can be established to minimize the potential for contamination. This may include: (1) work practices that minimize contact with potential contaminants; (2) using remote sampling techniques; (3) covering monitoring and sampling equipment with plastic, aluminum foil, or other protective material; (4) watering down dusty areas; (5) avoiding laying down equipment in areas of obvious contamination; and (6) use of disposable sampling equipment.

### 7.1 Decontamination Methods

All samples and equipment leaving the contaminated area of a site must be decontaminated to remove any contamination that may have adhered to equipment. Various decontamination methods will remove contaminants by: (1) flushing or other physical action, or (2) chemical complexing to inactivate

contaminants by neutralization, chemical reaction, disinfection, or sterilization.

Physical decontamination techniques can be grouped into two categories: abrasive methods and non-abrasive methods, as follows:

#### 7.1.1 Abrasive Cleaning Methods

Abrasive cleaning methods work by rubbing and wearing away the top layer of the surface containing the contaminant. The mechanical abrasive cleaning methods are most commonly used at hazardous waste sites. The following abrasive methods are available:

##### Mechanical

Mechanical methods of decontamination include using metal or nylon brushes. The amount and type of contaminants removed will vary with the hardness of bristles, length of time brushed, degree of brush contact, degree of contamination, nature of the surface being cleaned, and degree of contaminant adherence to the surface.

##### Air Blasting

Air blasting equipment uses compressed air to force abrasive material through a nozzle at high velocities. The distance between nozzle and surface cleaned, air pressure, time of application, and angle at which the abrasive strikes the surface will dictate cleaning efficiency. Disadvantages of this method are the inability to control the amount of material removed and the large amount of waste generated.

##### Wet Blasting

Wet blast cleaning involves use of a suspended fine abrasive. The abrasive/water mixture is delivered by compressed air to the contaminated area. By using a very fine abrasive, the amount of materials removed can be carefully controlled.

#### 7.1.2 Non-Abrasive Cleaning Methods

Non-abrasive cleaning methods work by forcing the contaminant off a surface with pressure. In general, the equipment surface is not removed using non-abrasive methods.

### Low-Pressure Water

This method consists of a container which is filled with water. The user pumps air out of the container to create a vacuum. A slender nozzle and hose allow the user to spray in hard-to-reach places.

### High-Pressure Water

This method consists of a high-pressure pump, an operator controlled directional nozzle, and a high-pressure hose. Operating pressure usually ranges from 340 to 680 atmospheres (atm) and flow rates usually range from 20 to 140 liters per minute.

### Ultra-High-Pressure Water

This system produces a water jet that is pressured from 1,000 to 4,000 atmospheres. This ultra-high-pressure spray can remove tightly-adhered surface films. The water velocity ranges from 500 meters/second (m/s) (1,000 atm) to 900 m/s (4,000 atm). Additives can be used to enhance the cleaning action.

### Rinsing

Contaminants are removed by rinsing through dilution, physical attraction, and solubilization.

### Damp Cloth Removal

In some instances, due to sensitive, non-waterproof equipment or due to the unlikelihood of equipment being contaminated, it is not necessary to conduct an extensive decontamination procedure. For example, air sampling pumps hooked on a fence, placed on a drum, or wrapped in plastic bags are not likely to become heavily contaminated. A damp cloth should be used to wipe off contaminants which may have adhered to equipment through airborne contaminants or from surfaces upon which the equipment was set.

### Disinfection/Sterilization

Disinfectants are a practical means of inactivating infectious agents. Unfortunately, standard sterilization methods are impractical for large equipment. This method of decontamination is typically performed off-site.

## **7.2 Field Sampling Equipment Decontamination Procedures**

The decontamination line is setup so that the first station is used to clean the most contaminated item. It progresses to the last station where the least contaminated item is cleaned. The spread of contaminants is further reduced by separating each decontamination station by a minimum of three (3) feet. Ideally, the contamination should decrease as the equipment progresses from one station to another farther along in the line.

A site is typically divided up into the following boundaries: Hot Zone or Exclusion Zone (EZ), the Contamination Reduction Zone (CRZ), and the Support or Safe Zone (SZ). The decontamination line should be setup in the Contamination Reduction Corridor (CRC) which is in the CRZ. Figure 1 (Appendix B) shows a typical contaminant reduction zone layout. The CRC controls access into and out of the exclusion zone and confines decontamination activities to a limited area. The CRC boundaries should be conspicuously marked. The far end is the hotline, the boundary between the exclusion zone and the contamination reduction zone. The size of the decontamination corridor depends on the number of stations in the decontamination process, overall dimensions of the work zones, and amount of space available at the site. Whenever possible, it should be a straight line.

Anyone in the CRC should be wearing the level of protection designated for the decontamination crew. Another corridor may be required for the entry and exit of heavy equipment. Sampling and monitoring equipment and sampling supplies are all maintained outside of the CRC. Personnel don their equipment away from the CRC and enter the exclusion zone through a separate access control point at the hotline. One person (or more) dedicated to decontaminating equipment is recommended.

### **7.2.1 Decontamination Setup**

Starting with the most contaminated station, the decontamination setup should be as follows:

#### Station 1: Segregate Equipment Drop

Place plastic sheeting on the ground (Figure 2, Appendix B). Size will depend on amount of

equipment to be decontaminated. Provide containers lined with plastic if equipment is to be segregated. Segregation may be required if sensitive equipment or mildly contaminated equipment is used at the same time as equipment which is likely to be heavily contaminated.

#### Station 2: Physical Removal With A High-Pressure Washer (Optional)

As indicated in 7.1.2, a high-pressure wash may be required for compounds which are difficult to remove by washing with brushes. The elevated temperature of the water from the high-pressure washers is excellent at removing greasy/oily compounds. High pressure washers require water and electricity.

A decontamination pad may be required for the high-pressure wash area. An example of a wash pad may consist of an approximately 1 1/2 foot-deep basin lined with plastic sheeting and sloped to a sump at one corner. A layer of sand can be placed over the plastic and the basin is filled with gravel or shell. The sump is also lined with visqueen and a barrel is placed in the hole to prevent collapse. A sump pump is used to remove the water from the sump for transfer into a drum.

Typically heavy machinery is decontaminated at the end of the day unless site sampling requires that the machinery be decontaminated frequently. A separate decontamination pad may be required for heavy equipment.

#### Station 3: Physical Removal With Brushes And A Wash Basin

Prior to setting up Station 3, place plastic sheeting on the ground to cover areas under Station 3 through Station 10.

Fill a wash basin, a large bucket, or child's swimming pool with non-phosphate detergent and tap water. Several bottle and bristle brushes to physically remove contamination should be dedicated to this station. Approximately 10 - 50 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

#### Station 4: Water Basin

Fill a wash basin, a large bucket, or child's swimming

pool with tap water. Several bottle and bristle brushes should be dedicated to this station. Approximately 10-50 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

#### Station 5: Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to contain the water during the rinsing process. Approximately 10-20 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

#### Station 6: Nitric Acid Sprayers

Fill a spray bottle with 10% nitric acid. An acid rinse may not be required if inorganics are not a contaminant of concern. The amount of acid will depend on the amount of equipment to be decontaminated. Provide a 5-gallon bucket or basin to collect acid during the rinsing process.

#### Station 7: Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to collect water during the rinsate process.

#### Station 8: Organic Solvent Sprayers

Fill a spray bottle with an organic solvent. After each solvent rinse, the equipment should be rinsed with distilled/deionized water and air dried. Amount of solvent will depend on the amount of equipment to decontaminate. Provide a 5-gallon bucket or basin to collect the solvent during the rinsing process.

Solvent rinses may not be required unless organics are a contaminant of concern, and may be eliminated from the station sequence.

#### Station 9: Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to collect water during the rinsate process.

#### Station 10: Clean Equipment Drop

Lay a clean piece of plastic sheeting over the bottom



plastic layer. This will allow easy removal of the plastic in the event that it becomes dirty. Provide aluminum foil, plastic, or other protective material to wrap clean equipment.

## 7.2.2 Decontamination Procedures

### Station 1: Segregate Equipment Drop

Deposit equipment used on-site (i.e., tools, sampling devices and containers, monitoring instruments radios, clipboards, etc.) on the plastic drop cloth/sheet or in different containers with plastic liners. Each will be contaminated to a different degree. Segregation at the drop reduces the probability of cross contamination. Loose leaf sampling data sheets or maps can be placed in plastic zip lock bags if contamination is evident.

### Station 2: Physical Removal With A High-Pressure Washer (Optional)

Use high pressure wash on grossly contaminated equipment. Do not use high- pressure wash on sensitive or non-waterproof equipment.

### Station 3: Physical Removal With Brushes And A Wash Basin

Scrub equipment with soap and water using bottle and bristle brushes. Only sensitive equipment (i.e., radios, air monitoring and sampling equipment) which is waterproof should be washed. Equipment which is not waterproof should have plastic bags removed and wiped down with a damp cloth. Acids and organic rinses may also ruin sensitive equipment. Consult the manufacturers for recommended decontamination solutions.

### Station 4: Equipment Rinse

Wash soap off of equipment with water by immersing the equipment in the water while brushing. Repeat as many times as necessary.

### Station 5: Low-Pressure Rinse

Rinse sampling equipment with distilled/deionized water with a low-pressure sprayer.

### Station 6: Nitric Acid Sprayers ( required only if metals are a contaminant of concern)

Using a spray bottle rinse sampling equipment with nitric acid. Begin spraying (inside and outside) at one end of the equipment allowing the acid to drip to the other end into a 5-gallon bucket. A rinsate blank may be required at this station. Refer to Section 9.

### Station 7: Low-Pressure Sprayers

Rinse sampling equipment with distilled/deionized water with a low-pressure sprayer.

### Station 8: Organic Solvent Sprayers

Rinse sampling equipment with a solvent. Begin spraying (inside and outside) at one end of the equipment allowing the solvent to drip to the other end into a 5-gallon bucket. Allow the solvent to evaporate from the equipment before going to the next station. A QC rinsate sample may be required at this station.

### Station 9: Low-Pressure Sprayers

Rinse sampling equipment with distilled/deionized water with a low-pressure washer.

### Station 10: Clean Equipment Drop

Lay clean equipment on plastic sheeting. Once air dried, wrap sampling equipment with aluminum foil, plastic, or other protective material.

## 7.2.3 Post Decontamination Procedures

1. Collect high-pressure pad and heavy equipment decontamination area liquid and waste and store in appropriate drum or container. A sump pump can aid in the collection process. Refer to the Department of Transportation (DOT) requirements for appropriate containers based on the contaminant of concern.
2. Collect high-pressure pad and heavy equipment decontamination area solid waste and store in appropriate drum or container. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.
3. Empty soap and water liquid wastes from basins and buckets and store in appropriate

drum or container. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.

4. Empty acid rinse waste and place in appropriate container or neutralize with a base and place in appropriate drum. pH paper or an equivalent pH test is required for neutralization. Consult DOT requirements for appropriate drum for acid rinse waste.
5. Empty solvent rinse sprayer and solvent waste into an appropriate container. Consult DOT requirements for appropriate drum for solvent rinse waste.
6. Using low-pressure sprayers, rinse basins, and brushes. Place liquid generated from this process into the wash water rinse container.
7. Empty low-pressure sprayer water onto the ground.
8. Place all solid waste materials generated from the decontamination area (i.e., gloves and plastic sheeting, etc.) in an approved DOT drum. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.
9. Write appropriate labels for waste and make arrangements for disposal. Consult DOT regulations for the appropriate label for each drum generated from the decontamination process.

## **8.0 CALCULATIONS**

This section is not applicable to this SOP.

## **9.0 QUALITY ASSURANCE/ QUALITY CONTROL**

A rinsate blank is one specific type of quality control sample associated with the field decontamination process. This sample will provide information on the effectiveness of the decontamination process employed in the field.

Rinsate blanks are samples obtained by running analyte free water over decontaminated sampling

equipment to test for residual contamination. The blank water is collected in sample containers for handling, shipment, and analysis. These samples are treated identical to samples collected that day. A rinsate blank is used to assess cross contamination brought about by improper decontamination procedures. Where dedicated sampling equipment is not utilized, collect one rinsate blank per day per type of sampling device samples to meet QA2 and QA3 objectives.

If sampling equipment requires the use of plastic tubing it should be disposed of as contaminated and replaced with clean tubing before additional sampling occurs.

## **10.0 DATA VALIDATION**

Results of quality control samples will be evaluated for contamination. This information will be utilized to qualify the environmental sample results in accordance with the project's data quality objectives.

## **11.0 HEALTH AND SAFETY**

When working with potentially hazardous materials, follow OSHA, U.S. EPA, corporate, and other applicable health and safety procedures.

Decontamination can pose hazards under certain circumstances. Hazardous substances may be incompatible with decontamination materials. For example, the decontamination solution may react with contaminants to produce heat, explosion, or toxic products. Also, vapors from decontamination solutions may pose a direct health hazard to workers by inhalation, contact, fire, or explosion.

The decontamination solutions must be determined to be acceptable before use. Decontamination materials may degrade protective clothing or equipment; some solvents can permeate protective clothing. If decontamination materials do pose a health hazard, measures should be taken to protect personnel or substitutions should be made to eliminate the hazard. The choice of respiratory protection based on contaminants of concern from the site may not be appropriate for solvents used in the decontamination process.

Safety considerations should be addressed when using abrasive and non-abrasive decontamination

equipment. Maximum air pressure produced by abrasive equipment could cause physical injury. Displaced material requires control mechanisms.

Material generated from decontamination activities requires proper handling, storage, and disposal. Personal Protective Equipment may be required for these activities.

Material safety data sheets are required for all decontamination solvents or solutions as required by the Hazard Communication Standard (i.e., acetone, alcohol, and trisodiumphosphate).

In some jurisdictions, phosphate containing detergents (i.e., TSP) are banned.

## 12.0 REFERENCES

Field Sampling Procedures Manual, New Jersey Department of Environmental Protection, February, 1988.

A Compendium of Superfund Field Operations Methods, EPA 540/p-87/001.

Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual, USEPA Region IV, April 1, 1986.

Guidelines for the Selection of Chemical Protective Clothing, Volume 1, Third Edition, American Conference of Governmental Industrial Hygienists, Inc., February, 1987.

Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, NIOSH/OSHA/USCG/EPA, October, 1985.

## APPENDIX A

Table

Table 1. Soluble Contaminants and Recommended Solvent Rinse

TABLE 1 Soluble Contaminants and Recommended Solvent Rinse		
SOLVENT <sup>(1)</sup>	EXAMPLES OF SOLVENTS	SOLUBLE CONTAMINANTS
Water	Deionized water Tap water	Low-chain hydrocarbons Inorganic compounds Salts Some organic acids and other polar compounds
Dilute Acids	Nitric acid Acetic acid Boric acid	Basic (caustic) compounds (e.g., amines and hydrazines)
Dilute Bases	Sodium bicarbonate (e.g., soap detergent)	Acidic compounds Phenol Thiols Some nitro and sulfonic compounds
Organic Solvents <sup>(2)</sup>	Alcohols Ethers Ketones Aromatics Straight chain alkalines (e.g., hexane) Common petroleum products (e.g., fuel, oil, kerosene)	Nonpolar compounds (e.g., some organic compounds)
Organic Solvent <sup>(2)</sup>	Hexane	PCBs

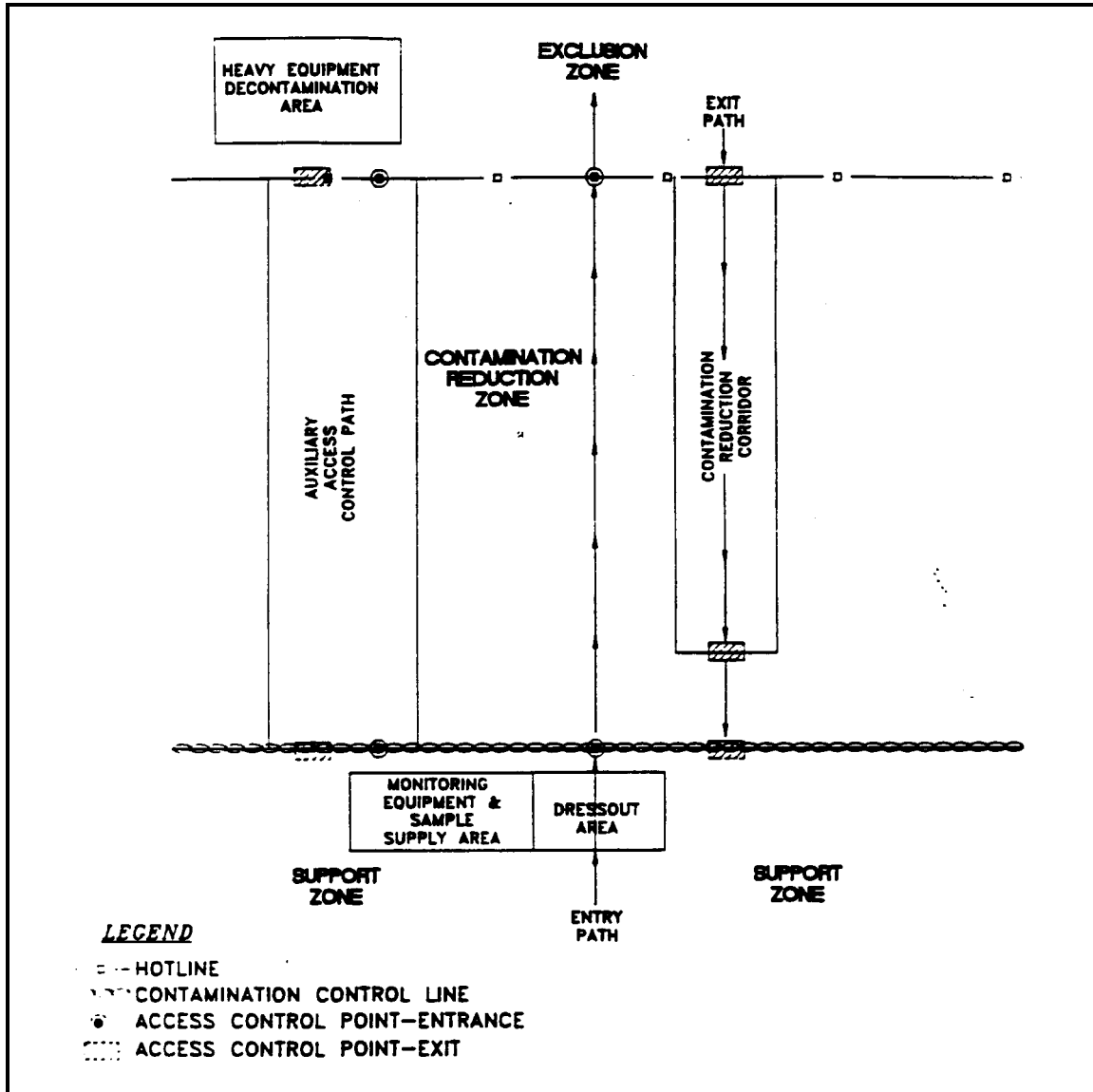
<sup>(1)</sup> - Material safety data sheets are required for all decontamination solvents or solutions as required by the Hazard Communication Standard

<sup>(2)</sup> - WARNING: Some organic solvents can permeate and/or degrade the protective clothing

## APPENDIX B

### Figures

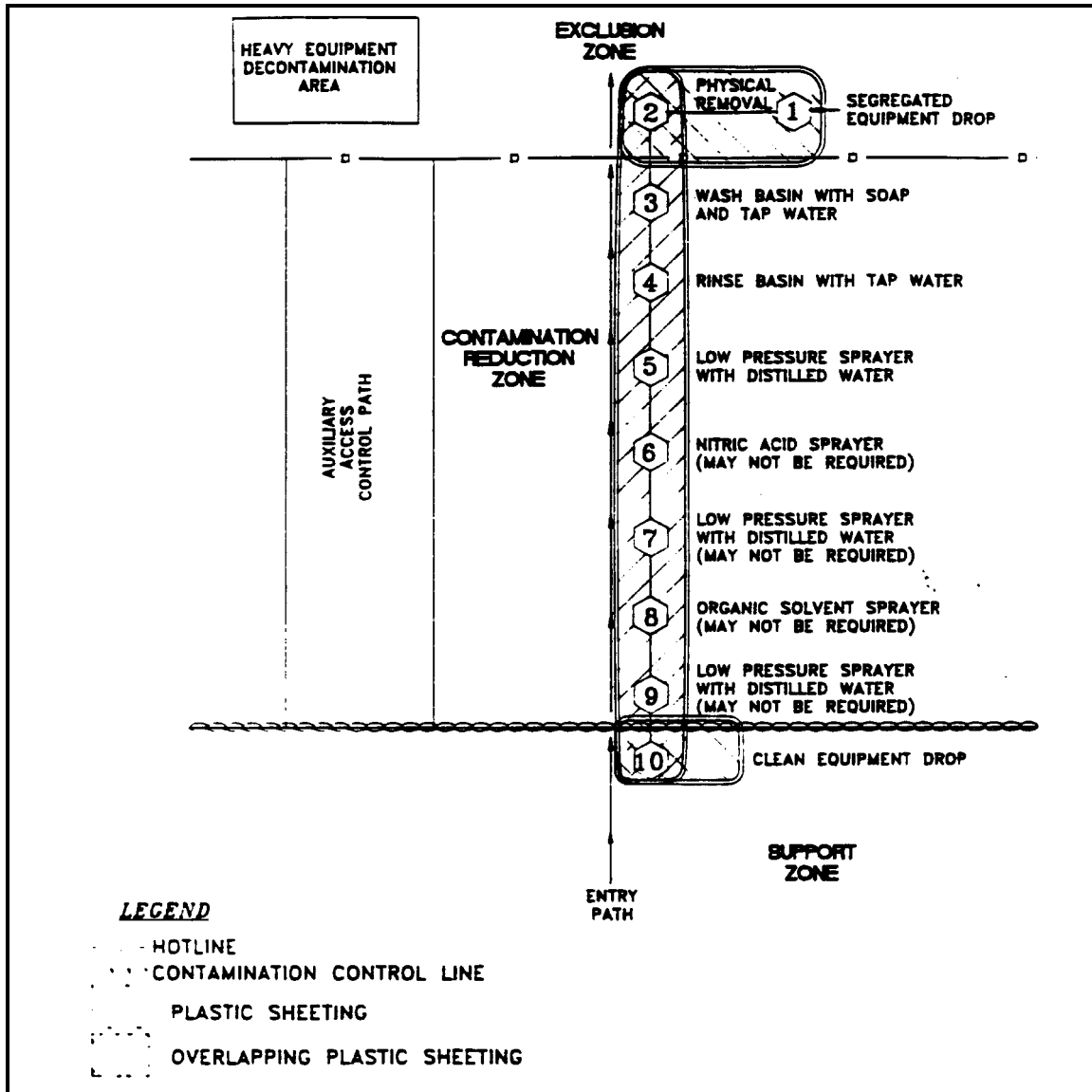
Figure 1. Contamination Reduction Zone Layout



## APPENDIX B (Cont'd.)

### Figures

Figure 2. Decontamination Layout





# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 1 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

#### CONTENTS

1.0	SCOPE AND APPLICATION
2.0	METHOD SUMMARY
3.0	SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE
4.0	POTENTIAL PROBLEMS
5.0	EQUIPMENT
6.0	REAGENTS
7.0	PROCEDURES
7.1	Preparation
7.2	Sample Collection
7.2.1	Surface Soil Samples
7.2.2	Sampling at Depth with Augers and Thin Wall Tube Samplers
7.2.3	Sampling at Depth with a Trier
7.2.4	Sampling at Depth with a Split Spoon (Barrel) Sampler
7.2.5	Test Pit/Trench Excavation
8.0	CALCULATIONS
9.0	QUALITY ASSURANCE/QUALITY CONTROL
10.0	DATA VALIDATION
11.0	HEALTH AND SAFETY
12.0	REFERENCES
13.0	APPENDIX
	Figures



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 2 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

#### 1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to describe the procedures for the collection of representative soil samples. Sampling depths are assumed to be those that can be reached without the use of a drill rig, direct-push, or other mechanized equipment (except for a back-hoe). Analysis of soil samples may determine whether concentrations of specific pollutants exceed established action levels, or if the concentrations of pollutants present a risk to public health, welfare, or the environment.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the actual procedures used should be documented and described in an appropriate site report.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (EPA) endorsement or recommendation for use.

#### 2.0 METHOD SUMMARY

Soil samples may be collected using a variety of methods and equipment depending on the depth of the desired sample, the type of sample required (disturbed vs. undisturbed), and the soil type. Near-surface soils may be easily sampled using a spade, trowel, and scoop. Sampling at greater depths may be performed using a hand auger, continuous flight auger, a trier, a split-spoon, or, if required, a backhoe.

#### 3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Chemical preservation of solids is not generally recommended. Samples should, however, be cooled and protected from sunlight to minimize any potential reaction. The amount of sample to be collected and proper sample container type are discussed in ERT/REAC SOP #2003 Rev. 0.0 08/11/94, *Sample Storage, Preservation and Handling*.

#### 4.0 INTERFERENCES AND POTENTIAL PROBLEMS

There are two primary potential problems associated with soil sampling - cross contamination of samples and improper sample collection. Cross contamination problems can be eliminated or minimized through the use of dedicated sampling equipment. If this is not possible or practical, then decontamination of sampling equipment is necessary. Improper sample collection can involve using contaminated equipment, disturbance of the matrix resulting in compaction of the sample, or inadequate homogenization of the samples where required, resulting in variable, non-representative results.

#### 5.0 EQUIPMENT





# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 3 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

Soil sampling equipment includes the following:

- Maps/plot plan
- Safety equipment, as specified in the site-specific Health and Safety Plan
- Survey equipment or global positioning system (GPS) to locate sampling points
- Tape measure
- Survey stakes or flags
- Camera and film
- Stainless steel, plastic, or other appropriate homogenization bucket, bowl or pan
- Appropriate size sample containers
- Ziplock plastic bags
- Logbook
- Labels
- Chain of Custody records and custody seals
- Field data sheets and sample labels
- Cooler(s)
- Ice
- Vermiculite
- Decontamination supplies/equipment
- Canvas or plastic sheet
- Spade or shovel
- Spatula
- Scoop
- Plastic or stainless steel spoons
- Trowel(s)
- Continuous flight (screw) auger
- Bucket auger
- Post hole auger
- Extension rods
- T-handle
- Sampling trier
- Thin wall tube sampler
- Split spoons
- Vehimeyer soil sampler outfit
  - Tubes
  - Points
  - Drive head
  - Drop hammer
  - Puller jack and grip
- Backhoe



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 4 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

Reagents are not used for the preservation of soil samples. Decontamination solutions are specified in ERT/REAC SOP #2006 Rev. 0.0 08/11/94, *Sampling Equipment Decontamination*, and the site specific work plan.

#### 7.0 PROCEDURES

##### 7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and the types and amounts of equipment and supplies required.
2. Obtain necessary sampling and monitoring equipment.
3. Decontaminate or pre-clean equipment, and ensure that it is in working order.
4. Prepare schedules and coordinate with staff, client, and regulatory agencies, if appropriate.
5. Perform a general site survey prior to site entry in accordance with the site specific Health and Safety Plan.
6. Use stakes, flagging, or buoys to identify and mark all sampling locations. Specific site factors, including extent and nature of contaminant, should be considered when selecting sample location. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions. All staked locations should be utility-cleared by the property owner or the On-Scene-Coordinator (OSC) prior to soil sampling; and utility clearance should always be confirmed before beginning work.

##### 7.2 Sample Collection

###### 7.2.1 Surface Soil Samples

Collection of samples from near-surface soil can be accomplished with tools such as spades, shovels, trowels, and scoops. Surface material is removed to the required depth and a stainless steel or plastic scoop is then used to collect the sample.

This method can be used in most soil types but is limited to sampling at or near the ground surface. Accurate, representative samples can be collected with this procedure depending on the care and precision demonstrated by the sample team member. A flat, pointed mason trowel to cut a block of the desired soil is helpful when undisturbed profiles are required. Tools plated with chrome or other materials should not be used. Plating is particularly common with garden implements such as potting trowels.

The following procedure is used to collect surface soil samples:



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 5 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

1. Carefully remove the top layer of soil or debris to the desired sample depth with a pre-cleaned spade.
2. Using a pre-cleaned, stainless steel scoop, plastic spoon, or trowel, remove and discard a thin layer of soil from the area which came in contact with the spade.
3. If volatile organic analysis is to be performed, transfer the sample directly into an appropriate, labeled sample container with a stainless steel lab spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval or location into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

#### 7.2.2 Sampling at Depth with Augers and Thin Wall Tube Samplers

This system consists of an auger, or a thin-wall tube sampler, a series of extensions, and a "T" handle (Figure 1, Appendix A). The auger is used to bore a hole to a desired sampling depth, and is then withdrawn. The sample may be collected directly from the auger. If a core sample is to be collected, the auger tip is then replaced with a thin wall tube sampler. The system is then lowered down the borehole, and driven into the soil to the completion depth. The system is withdrawn and the core is collected from the thin wall tube sampler.

Several types of augers are available; these include: bucket type, continuous flight (screw), and post-hole augers. Bucket type augers are better for direct sample recovery because they provide a large volume of sample in a short time. When continuous flight augers are used, the sample can be collected directly from the flights. The continuous flight augers are satisfactory when a composite of the complete soil column is desired. Post-hole augers have limited utility for sample collection as they are designed to cut through fibrous, rooted, swampy soil and cannot be used below a depth of approximately three feet.

The following procedure is used for collecting soil samples with the auger:

1. Attach the auger bit to a drill rod extension, and attach the "T" handle to the drill rod.



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 6 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

2. Clear the area to be sampled of any surface debris (e.g., twigs, rocks, litter). It may be advisable to remove the first three to six inches of surface soil for an area approximately six inches in radius around the drilling location.
3. Begin augering, periodically removing and depositing accumulated soils onto a plastic sheet spread near the hole. This prevents accidental brushing of loose material back down the borehole when removing the auger or adding drill rods. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.
4. After reaching the desired depth, slowly and carefully remove the auger from the hole. When sampling directly from the auger, collect the sample after the auger is removed from the hole and proceed to Step 10.
5. Remove auger tip from the extension rods and replace with a pre-cleaned thin wall tube sampler. Install the proper cutting tip.
6. Carefully lower the tube sampler down the borehole. Gradually force the tube sampler into the soil. Do not scrape the borehole sides. Avoid hammering the rods as the vibrations may cause the boring walls to collapse.
7. Remove the tube sampler, and unscrew the drill rods.
8. Remove the cutting tip and the core from the device.
9. Discard the top of the core (approximately 1 inch), as this possibly represents material collected before penetration of the layer of concern. Place the remaining core into the appropriate labeled sample container. Sample homogenization is not required.
10. If volatile organic analysis is to be performed, transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly.

When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 7 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

11. If another sample is to be collected in the same hole, but at a greater depth, reattach the auger bit to the drill and assembly, and follow steps 3 through 11, making sure to decontaminate the auger and tube sampler between samples.
12. Abandon the hole according to applicable state regulations. Generally, shallow holes can simply be backfilled with the removed soil material.

#### 7.2.3 Sampling with a Trier

The system consists of a trier, and a "T" handle. The auger is driven into the soil to be sampled and used to extract a core sample from the appropriate depth.

The following procedure is used to collect soil samples with a sampling trier:

1. Insert the trier (Figure 2, Appendix A) into the material to be sampled at a 0° to 45° angle from horizontal. This orientation minimizes the spillage of sample.
2. Rotate the trier once or twice to cut a core of material.
3. Slowly withdraw the trier, making sure that the slot is facing upward.
4. If volatile organic analyses are required, transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

#### 7.2.4 Sampling at Depth with a Split Spoon (Barrel) Sampler

Split spoon sampling is generally used to collect undisturbed soil cores of 18 or 24 inches in length. A series of consecutive cores may be extracted with a split spoon sampler to give a complete soil column profile, or an auger may be used to drill down to the desired depth for sampling. The split spoon is then driven to its sampling depth through the bottom of the augured hole and the core extracted.

When split spoon sampling is performed to gain geologic information, all work should



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 8 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

be performed in accordance with ASTM D1586-98, "Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils".

The following procedures are used for collecting soil samples with a split spoon:

1. Assemble the sampler by aligning both sides of barrel and then screwing the drive shoe on the bottom and the head piece on top.
2. Place the sampler in a perpendicular position on the sample material.
3. Using a well ring, drive the tube. Do not drive past the bottom of the head piece or compression of the sample will result.
4. Record in the site logbook or on field data sheets the length of the tube used to penetrate the material being sampled, and the number of blows required to obtain this depth.
5. Withdraw the sampler, and open by unscrewing the bit and head and splitting the barrel. The amount of recovery and soil type should be recorded on the boring log. If a split sample is desired, a cleaned, stainless steel knife should be used to divide the tube contents in half, longitudinally. This sampler is typically available in 2 and 3 1/2 inch diameters. A larger barrel may be necessary to obtain the required sample volume.
6. Without disturbing the core, transfer it to appropriate labeled sample container(s) and seal tightly.

#### 7.2.5 Test Pit/Trench Excavation

A backhoe can be used to remove sections of soil, when detailed examination of soil characteristics are required. This is probably the most expensive sampling method because of the relatively high cost of backhoe operation.

The following procedures are used for collecting soil samples from test pits or trenches:

1. Prior to any excavation with a backhoe, it is important to ensure that all sampling locations are clear of overhead and buried utilities.
2. Review the site specific Health & Safety plan and ensure that all safety precautions including appropriate monitoring equipment are installed as required.



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 9 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

3. Using the backhoe, excavate a trench approximately three feet wide and approximately one foot deep below the cleared sampling location. Place excavated soils on plastic sheets. Trenches greater than five feet deep must be sloped or protected by a shoring system, as required by OSHA regulations.
4. A shovel is used to remove a one to two inch layer of soil from the vertical face of the pit where sampling is to be done.
5. Samples are taken using a trowel, scoop, or coring device at the desired intervals. Be sure to scrape the vertical face at the point of sampling to remove any soil that may have fallen from above, and to expose fresh soil for sampling. In many instances, samples can be collected directly from the backhoe bucket.
6. If volatile organic analyses are required, transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.
7. Abandon the pit or excavation according to applicable state regulations. Generally, shallow excavations can simply be backfilled with the removed soil material.

#### 8.0 CALCULATIONS

This section is not applicable to this SOP.

#### 9.0 QUALITY ASSURANCE/QUALITY CONTROL

There are no specific quality assurance (QA) activities which apply to the implementation of these procedures. However, the following QA procedures apply:

1. All data must be documented on field data sheets or within site logbooks.
2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 10 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

activities must occur prior to sampling/operation, and they must be documented.

#### 10.0 DATA VALIDATION

This section is not applicable to this SOP.

#### 11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OHSA and corporate health and safety procedures, in addition to the procedures specified in the site specific Health & Safety Plan..

#### 12.0 REFERENCES

Mason, B.J. 1983. Preparation of Soil Sampling Protocol: Technique and Strategies. EPA-600/4-83-020.

Barth, D.S. and B.J. Mason. 1984. Soil Sampling Quality Assurance User's Guide. EPA-600/4-84-043.

U.S. Environmental Protection Agency. 1984 Characterization of Hazardous Waste Sites - A Methods Manual: Volume II. Available Sampling Methods, Second Edition. EPA-600/4-84-076.

de Vera, E.R., B.P. Simmons, R.D. Stephen, and D.L. Storm. 1980. Samplers and Sampling Procedures for Hazardous Waste Streams. EPA-600/2-80-018.

ASTM D 1586-98, ASTM Committee on Standards, Philadelphia, PA.





# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 11 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

#### APPENDIX A

Figures  
SOP #2012  
February 2000



# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

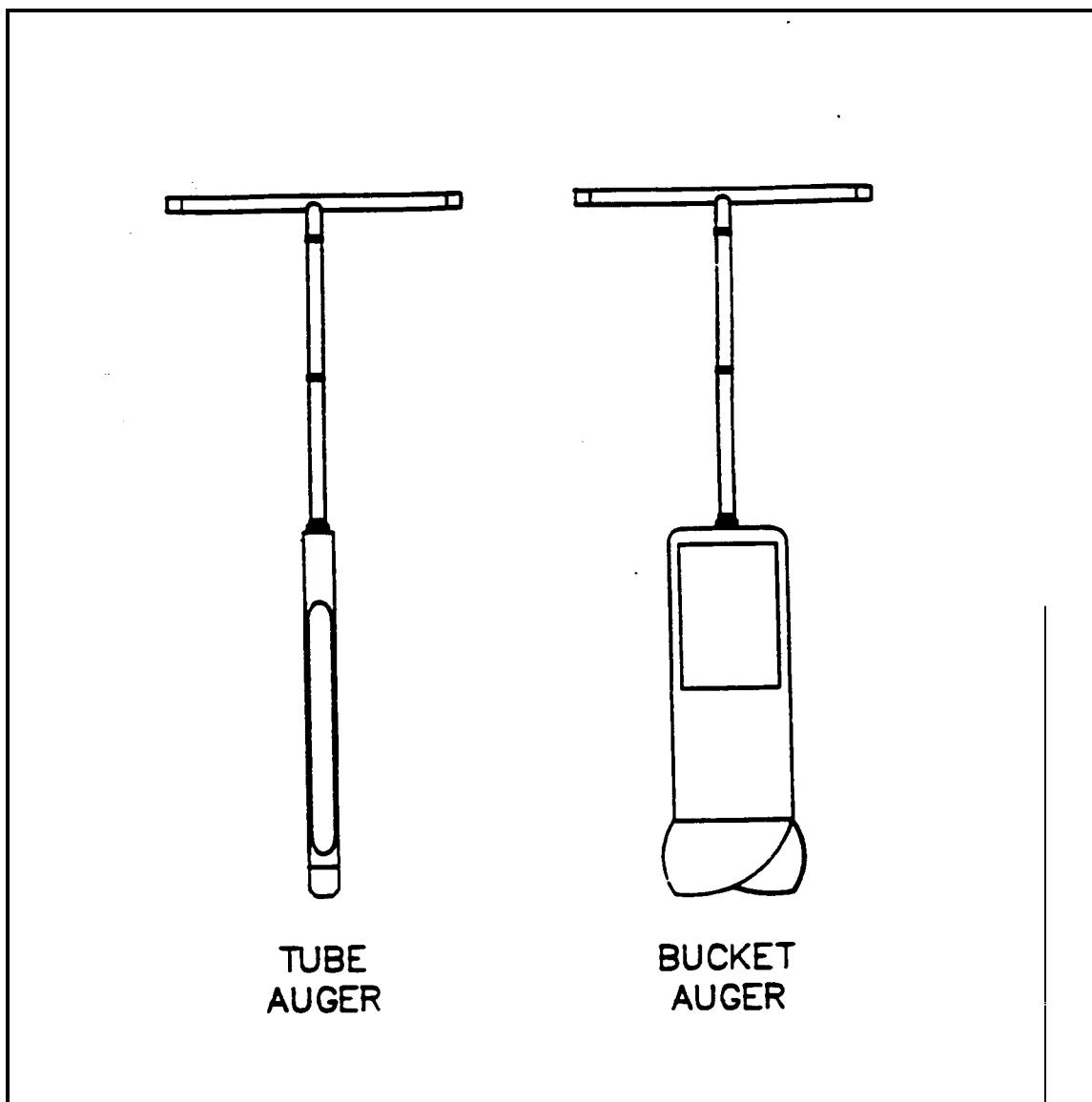
## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 12 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

FIGURE 1. Sampling Augers





# U. S. EPA ENVIRONMENTAL RESPONSE TEAM

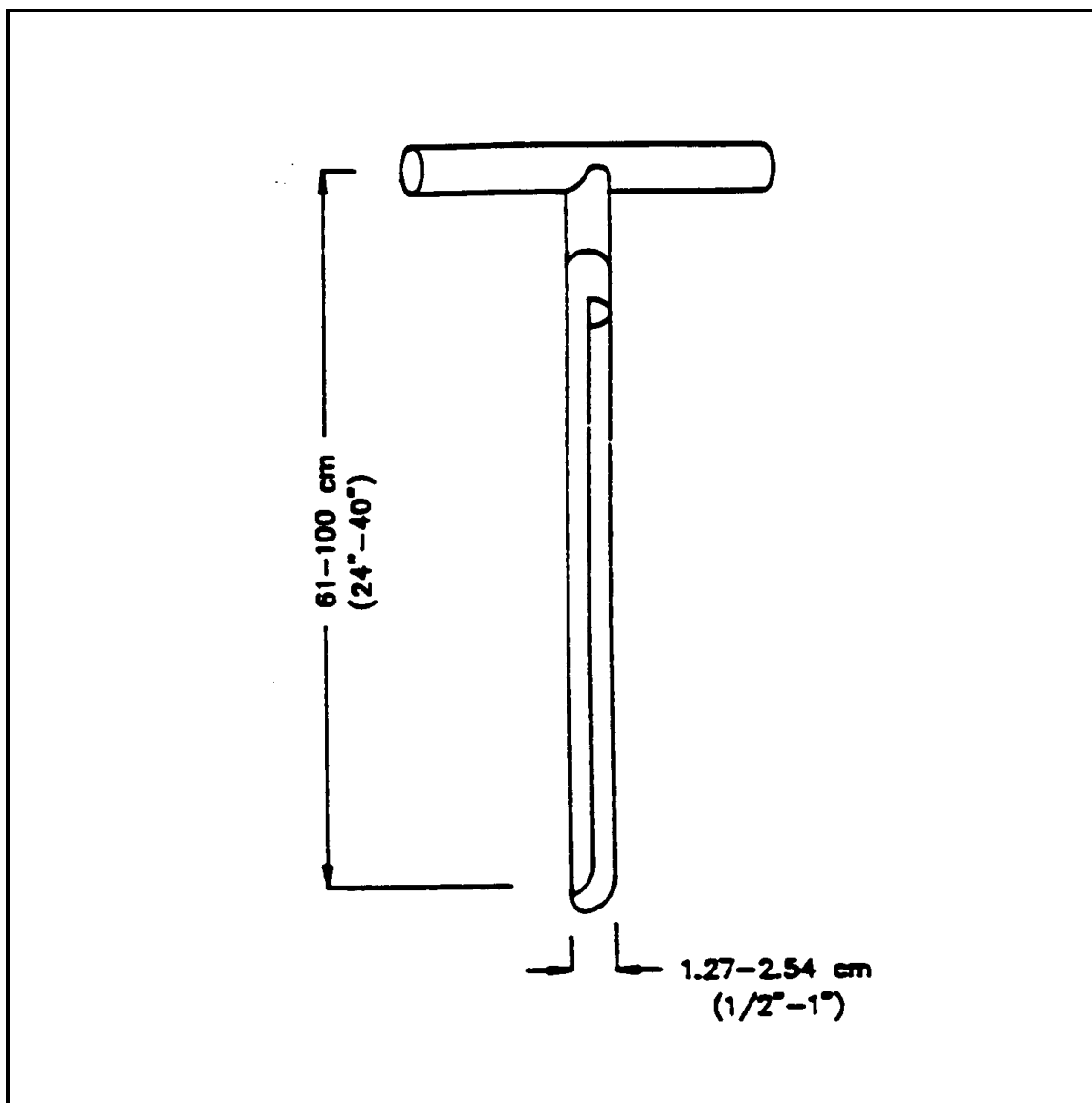
## STANDARD OPERATING PROCEDURES

SOP: 2012  
PAGE: 13 of 13  
REV: 0.0  
DATE: 02/18/00

### SOIL SAMPLING

---

FIGURE 2. Sampling Trier



## **ATTACHMENT C**

### **EPA Regional Removal Management Levels (RML) Residential Soil Table (TR=1E-6, HQ=3) January 2015**

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; J = New Jersey; O = EPA Office of Water; F = See FAQ; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; \* = where: n SL < 100X c SL; \*\* = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Child Hazard Index (HI) = 3					
SFO (mg/kg-day) <sup>-1</sup>	$k_e$ y	IUR (ug/m <sup>3</sup> ) <sup>-1</sup>	$k_e$ y	RfD <sub>c</sub> (mg/kg-day)	$k_e$ y	RfC <sub>c</sub> (mg/m <sup>3</sup> ) <sup>-1</sup>	$k_e$ y	o v o l u t i l e	muta- gen	GIABS	ABS	C <sub>sat</sub> (mg/kg)	PEF (m <sup>3</sup> /kg)	VF (m <sup>3</sup> /kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-4 (mg/kg)	Dermal SL TR=1.0E-4 (mg/kg)	Inhalation SL TR=1.0E-4 (mg/kg)	Carcinogenic SL TR=1.0E-4 (mg/kg)	Ingestion SL Child HQ=3 (mg/kg)	Dermal SL Child HQ=3 (mg/kg)	Inhalation SL Child HQ=3 (mg/kg)	Noncarcinogenic SL Child HI=3 (mg/kg)	
1.80E-02 8.70E-03	C I	5.10E-06 2.20E-06	C I	1.50E-01 4.00E-03	I I	9.00E-03 I	V			1 1	0.1 0.1	1.36E+09 1.36E+09	1.36E+09 1.07E+05	8.72E+03	ALAR Acephate Acetaldehyde	1596-84-5 30560-19-1 75-07-0	3.90E+03 8.00E+03	1.30E+04 2.60E+04	7.50E+07 1.10E+03	3.00E+03 6.10E+03 1.10E+03	3.50E+04 9.40E+02	1.30E+05 3.50E+03		2.80E+04 7.40E+02 2.50E+02	
				2.00E-02 9.00E-01	I I	3.10E+01 2.00E-03	A X	V V		1 1	0.1 1	1.36E+09 1.14E+05	1.36E+09 1.36E+09	1.37E+04 2.38E+04	Acetochlor Acetone Acetone Cyanohydrin	34256-82-1 67-64-1 75-86-5					4.70E+03 2.10E+05	1.70E+04		3.70E+03 1.80E+05 1.50E+02	
3.80E+00	C	1.30E-03	C	1.00E-01	I	6.00E-02	I	V		1 1	0.1 1	1.28E+05 2.52E+03	1.36E+09 1.36E+09	1.30E+04 5.97E+04	Acetonitrile Acetophenone Acetylaminofluorene, 2-	75-05-8 98-86-2 53-96-3	1.80E+01	6.00E+01	2.90E+05	1.40E+01	2.30E+04			2.40E+03 2.30E+04	
5.00E-01	I	1.00E-04	I	5.00E-04 2.00E-03 5.00E-01	I I I	2.00E-05 6.00E-03 1.00E-03	I V I		M	1 1 1	0.1 0.1 0.1	2.27E+04 1.36E+09 1.36E+09	1.36E+09 1.36E+09 1.36E+09	6.91E+03	Acrolein Acrylamide Acrylic Acid	107-02-8 79-06-1 79-10-7	3.10E+01	1.10E+02	1.40E+06	2.40E+01	1.20E+02 4.70E+02 1.20E+05	1.70E+03 1.70E+03 4.40E+05	4.30E-01 2.60E+07 4.30E+06	4.30E-01 3.70E+02 9.00E+04	
5.40E-01 5.60E-02	I C	6.80E-05 1.00E-02	I I	4.00E-02 1.00E-02	A I	2.00E-03 6.00E-03	I P	V I		1 1	0.1 0.1	1.13E+04 1.36E+09	1.36E+09 1.36E+09	7.69E+03	Acrylonitrile Adiponitrile Alachlor	107-13-1 111-69-3 15972-60-8	1.30E+02 1.20E+03		3.20E+01 4.10E+03	2.50E+01 9.50E+02	9.40E+03 2.30E+03	8.70E+03	4.80E+01 2.60E+07	4.80E+01 1.80E+03	
				1.00E-03 1.00E-03	I I					1 1	0.1 0.1	1.36E+09 1.36E+09	1.36E+09 1.36E+09		Aldicarb Aldicarb Sulfone Aldicarb sulfoxide	116-06-3 1646-88-4 1646-87-3					2.30E+02 2.30E+02	8.70E+02 8.70E+02		1.80E+02 1.80E+02	
1.70E+01	I	4.90E-03	I	3.00E-05 2.50E-01 5.00E-03	I I I	1.00E-04 I	X			1 1 1	0.1 0.1 0.1	1.36E+09 1.36E+09 1.36E+09	1.36E+09 1.36E+09 1.36E+09		Aldrin Allyl Allyl Alcohol	309-00-2 74223-64-6 107-18-6	4.10E+00	1.30E+01	7.80E+04	3.10E+00	7.00E+00 5.90E+04 1.20E+03	2.60E+01 2.20E+05 4.40E+03		5.50E+00 4.60E+04 9.20E+02	
2.10E-02	C	6.00E-06	C	1.00E+00 4.00E-04	P I	1.00E-03 5.00E-03	I P	V I		1 1	1 0.1	1.42E+03 1.36E+09	1.36E+09 1.36E+09	1.58E+03	Allyl Chloride Aluminum Aluminum Phosphide	107-05-1 7429-90-5 20859-73-8	3.30E+03		7.40E+01	7.20E+01	2.30E+05 9.40E+01		5.00E+00 2.10E+07	5.00E+00 2.30E+05 9.40E+01	
2.10E+01	C	6.00E-03	C	3.00E-04 9.00E-03	I I					1 1	0.1 0.1	1.36E+09 1.36E+09	1.36E+09 1.36E+09		Amdro Ametryn Aminobiphenyl, 4-	67485-29-4 834-12-8 92-67-1	3.30E+00	1.10E+01	6.40E+04	2.50E+00	7.00E+01 2.10E+03	2.60E+02 7.90E+03		5.50E+01 1.70E+03	
				8.00E-02 2.00E-02 2.50E-03	P P I					1 1 1	0.1 0.1 0.1	1.36E+09 1.36E+09 1.36E+09	1.36E+09 1.36E+09 1.36E+09		Aminophenol, m- Aminophenol, p- Amtraz	591-27-5 123-30-8 33089-61-1					1.90E+04 4.70E+03 5.90E+02	7.00E+04 1.70E+04 2.20E+03		1.50E+04 3.70E+03 4.60E+02	
				2.00E-01 I	I	1.00E-01 I	I			1 1	1 0.1	1.36E+09 1.36E+09	1.36E+09 1.36E+09	2.62E+04	Ammonia Ammonium Sulfamate Amyl Alcohol, tert-	7664-41-7 7773-06-0 75-85-4					4.70E+04		2.50E+02	4.70E+04 2.50E+02	
5.70E-03 4.00E-02	I P	1.60E-06 I	C	7.00E-03 2.00E-03 4.00E-04	P I I	1.00E-03 I	I			1 1 0.15	0.1 0.1	1.36E+09 1.36E+09 1.36E+09	1.36E+09 1.36E+09 1.36E+09		Aniline Anthraquinone, 9,10- Antimony (metallic)	62-53-3 84-65-1 7440-36-0	1.20E+04 1.70E+03	4.00E+04 5.70E+03	2.40E+08 1.30E+03	9.30E+03 1.30E+03	1.60E+03 4.70E+02 9.40E+01	6.10E+03 1.70E+03	4.30E+06	1.30E+03 3.70E+02 9.40E+01	
				5.00E-04 9.00E-04 4.00E-04	H H H					0.15 0.15 0.15		1.36E+09 1.36E+09 1.36E+09	1.36E+09 1.36E+09 1.36E+09		Antimony Pentoxide Antimony Potassium Tartrate Antimony Trioxide	1314-60-9 11071-15-1 332-81-6					1.20E+02 2.10E+02 9.40E+01			1.20E+02 2.10E+02 9.40E+01	
2.50E-02	I	7.10E-06	I	1.30E-02 5.00E-02	I H	2.00E-04 I				0.15 0.1		1.36E+09 1.36E+09	1.36E+09 1.36E+09		Antimony Trioxide Apollo Aramite	1309-64-4 74115-24-5 140-57-8	2.80E+03 7.70E+01	9.10E+03 5.10E+02	5.40E+07 8.90E+04	2.10E+03 6.70E+01	3.10E+03 1.20E+04	1.10E+04 4.40E+04		8.50E+05 2.40E+03 9.20E+03	
1.50E+00	I	4.30E-03	I	3.00E-04 3.50E-06 9.00E-03	I C I	1.50E-05 5.00E-05	C I			0.03 1 0.1		1.36E+09 1.36E+09 1.36E+09	1.36E+09 1.36E+09 1.36E+09		Arsenic, Inorganic Arsine Assure	7440-38-2 7784-42-1 76578-14-8	7.70E+01	5.10E+02	8.90E+04	6.70E+01	1.20E+02 8.20E-01 2.10E+03	8.70E+02 2.10E+05	6.40E+04 2.10E+05	1.00E+02 8.20E-01 1.70E+03	
2.30E-01 8.80E-01	C C	2.50E-04 C		5.00E-02 3.50E-02	I I					1 1	0.1 0.1	1.36E+09 1.36E+09	1.36E+09 1.36E+09		Asulam Atrazine Auramine	3337-71-1 1912-24-9 492-80-8	3.00E+02 7.90E+01	9.90E+02 2.60E+02		2.30E+02 6.10E+01	1.20E+04 8.20E+03	4.40E+04 3.10E+04		9.20E+03 6.50E+03	
1.10E-01	I	3.10E-05	I	4.00E-04 1.00E+00	I P	7.00E-06 P	V			1 1	0.1 0.1	1.36E+09 1.36E+09	1.36E+09 1.36E+09	5.23E+05	Avermectin B1 Azobenzene Azodicarbonamide	65195-55-3 103-33-3 123-77-3	6.30E+02		4.70E+03	5.60E+02	9.40E+01 2.30E+05	3.50E+02 8.70E+05		7.40E+01 2.60E+04	
5.00E-01	C	1.50E-01	C	2.00E-01 2.00E-02 4.00E-03	I C I	5.00E-04 2.00E-04	H C		M	0.07 0.025 1		1.36E+09 1.36E+09 1.36E+09	1.36E+09 1.36E+09 1.36E+09		Barium Barium Chromate Baygon	7440-39-3 10294-40-3 114-26-1	3.10E+01		9.20E+02	3.00E+01	4.70E+04 4.70E+03 9.40E+02	2.10E+06 8.50E+05		4.60E+04 4.70E+03 7.40E+02	
				3.00E-02 2.50E-02 3.00E-01	I I I					1 1 0.1	0.1 0.1 0.1	1.36E+09 1.36E+09 1.36E+09	1.36E+09 1.36E+09 1.36E+09		Bayleton Baythroid Benefin	43121-43-3 68359-37-5 1861-40-1					7.00E+03 5.90E+03 7.00E+04	2.60E+04 2.20E+04 2.60E+05		5.50E+03 4.60E+03 5.50E+04	
				5.00E-02 3.00E-02 1.00E-01	I I I					1 1 0.1	0.1 0.1 0.1	1.36E+09 1.36E+09 1.16E+03	1.36E+09 1.36E+09 1.36E+09	2.25E+04	Benomyl Bentazon Benzaldehyde	17804-35-2 25057-89-0 100-52-7					1.20E+04 7.00E+03 2.30E+04	4.40E+04 2.60E+04		9.20E+03 5.50E+03 2.30E+04	
5.50E-02 1.00E-01	I X	7.80E-06 I		4.00E-03 3.00E-04 1.00E-03	I X P	3.00E-02 I	V			1 1 1	1 0.1	1.82E+03 1.36E+09	1.36E+09 1.36E+09	3.54E+03	Benzene Benzenediamine-2-methyl sulfate, 1,4- Benzeneethiol	71-43-2 6369-59-1 108-98-5	1.30E+03 7.00E+02		1.30E+02 2.30E+03	1.20E+02 5.30E+02	9.40E+02 7.00E+01 2.30E+02		3.30E+02	2.50E+02 5.50E+01 2.30E+02	
2.30E+02 1.30E+01	I I	6.70E-02 I		3.00E-03 4.00E+00	I I			M		1 1	0.1 0.1	1.36E+09 1.36E+09	1.36E+09 3.24E+02	6.76E+04	Benzidine Benzoic Acid Benzotrichloride	92-87-5 65-85-0 98-07-7	6.70E-02 5.30E+00	2.30E-01	2.10E+03	5.20E-02 5.30E+00	7.00E+02 9.40E+05	2.60E+03 3.50E+06		5.50E+02 7.40E+05	
1.70E-01	I	4.90E-05	C	1.00E-01 2.00E-03	P I	1.00E-03 2.00E-05	P I	V		1 0.007	0.1 1	1.46E+03 1.36E+09	1.36E+09 1.36E+09	2.55E+04	Benzyl Alcohol Benzyl Chloride Beryllium and compounds	100-51-6 100-44-7 7440-41-7	4.10E+02		1.50E+02 1.60E+05	1.10E+02 1.60E+05	2.30E+04 4.70E+02	8.70E+04	8.00E+01 8.50E+04	1.80E+04 6.80E+01 4.70E+02	
				1.00E-04 9.00E-03 1.50E-02	I P I					1 1 0.1	0.1 0.1 0.1	1.36E+09 1.36E+09 1.36E+09	1.36E+09 1.36E+09 1.36E+09		Bidrin Bifenox Biphenitrin	141-66-2 42576-02-3 82657-04-3					2.30E+01 2.10E+03 3.50E+03	8.70E+01 7.90E+03 1.30E+04		1.80E+01 1.70E+03 2.80E+03	
8.00E-03 7.00E-02	I H	5.00E-01 1.00E-05	H	5.00E-01 4.00E-02 3.00E-03	I I P	4.00E-04 I	X V			1 1 1	1 0.1	1.36E+09 1.36E+09	1.36E+09 1.36E+09	1.14E+05 3.50E+04	Biphenyl, 1,1'- Bis(2-chloro-1-methylethyl) ether Bis(2-chloroethoxy)methane	92-52-4 108-60-1 111-91-1	8.70E+03 9.90E+02			8.70E+03 4.90E+02		1.20E+05 9.40E+03 7.00E+02		1.40E+02	1.40E+02 9.40E+03 5.50E+02

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; J = New Jersey; O = EPA Office of Water; F = See FAQ; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; \* = where: n SL < 100X c SL; \*\* = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Child Hazard Index (HI) = 3			
SFO (mg/kg-day) <sup>-1</sup>	k e y	IUR (ug/m <sup>3</sup> ) <sup>-1</sup>	k e y	RfD <sub>o</sub> (mg/kg-day)	k e y	RfC <sub>i</sub> (mg/m <sup>3</sup> )	k e y	muta- gen	GIABS	ABS	C <sub>sat</sub> (mg/kg)	PEF (m <sup>3</sup> /kg)	VF (m <sup>3</sup> /kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-4 (mg/kg)	Dermal SL TR=1.0E-4 (mg/kg)	Inhalation SL TR=1.0E-4 (mg/kg)	Carcinogenic SL TR=1.0E-4 (mg/kg)	Ingestion SL Child HQ=3 (mg/kg)	Dermal SL Child HQ=3 (mg/kg)	Inhalation SL Child HQ=3 (mg/kg)	Noncarcinogenic SL Child HI=3 (mg/kg)
1.10E+00 2.20E+02	I I	3.30E-04 6.20E-02	I I				V V		1 1		5.05E+03 4.22E+03	1.36E+09 1.36E+09	4.25E+04 1.88E+03	Bis(2-chloroethyl)ether Bis(chloromethyl)ether Bisphenol A	111-44-4 542-88-1 80-05-7	6.30E+01 3.20E-01		3.60E+01 8.50E-03	2.30E+01 8.30E-03		1.20E+04 4.40E+04		9.20E+03
				5.00E-02	I				1	0.1				Boron And Borates Only Boron Trichloride Boron Trifluoride	7440-42-8 10294-34-5 7637-07-2					4.70E+04 4.70E+05 9.40E+03		8.50E+07 8.50E+07 5.50E+07	4.70E+04 4.70E+05 9.40E+03
7.00E-01 2.00E+00	I X	4.00E-03 6.00E-04	I X				V V		1 1		2.38E+03 6.79E+02	1.36E+09 1.36E+09	5.92E+03 8.37E+03	Bromate Bromo-2-chloroethane, 1- Bromobenzene	15541-45-4 107-04-0 108-86-1	9.90E+01 3.50E+01		2.80E+00	9.90E+01 2.60E+00		9.40E+02 1.90E+03		9.40E+02
				8.00E-03	I	6.00E-02	I	V	1					Bromochloromethane Bromodichloromethane Bromoflorm	74-97-5 75-27-4 75-25-2	1.10E+03 8.80E+03	2.90E+04 2.90E+04	3.00E+01 3.50E+08	2.90E+01 6.70E+03	4.70E+03 4.70E+03	1.70E+04	4.50E+02	4.50E+02 4.70E+03 3.70E+03
6.20E-02 7.90E-03	I I	3.70E-05 1.10E-06	C I	2.00E-02 2.00E-02	I I		V V		1 1	0.1	4.04E+03 9.31E+02	1.36E+09 1.36E+09	3.58E+03 3.97E+03	Bromomethane Bromophos Bromoxynil	74-83-9 2104-96-3 1689-84-5					3.30E+02 1.20E+03 4.70E+03	4.40E+03 1.70E+04	2.20E+01	2.10E+01 9.20E+02 3.70E+03
				1.40E-03 5.00E-03 2.00E-02	I H I	5.00E-03	I	V	1 1 1	0.1	3.59E+03	1.36E+09	1.40E+03	Bromoxynil Octanoate Butadiene, 1,3- Butanol, N-	1689-99-2 106-99-0 71-36-3					4.70E+03 4.70E+03 4.70E+03	1.70E+04	5.40E+00	3.70E+03 5.40E+00 1.80E+04
3.40E+00	C	3.00E-05	I			2.00E-03	I	V	1	0.1	6.67E+02	1.36E+09	8.66E+02	Butyl Benzyl Phthlate Butyl alcohol, sec- Butylate	85-68-7 78-92-2 2008-41-5	3.70E+04	1.20E+05		2.80E+04	4.70E+04 4.70E+05 1.20E+04	8.70E+04 1.70E+06 4.40E+04	1.30E+11	3.70E+04 3.70E+05 9.20E+03
2.00E-04 3.60E-03	C P	5.70E-08 C		3.00E-01 5.00E-02	P P		V		1 1	0.1	1.08E+02	1.36E+09	8.14E+03	Butylated hydroxyanisole Butylated hydroxytoluene Butylbenzene, n-	25013-16-5 128-37-0 104-51-8	3.50E+05 1.90E+04	1.10E+06 6.30E+04	6.70E+09	2.70E+05 1.50E+04	7.00E+04 1.20E+04	2.60E+05		5.50E+04 1.20E+04
				1.00E-01 1.00E-01 2.00E-02	X X A		V V		1 1 1	0.1	1.45E+02 1.83E+02	1.36E+09 1.36E+09	7.35E+03 7.36E+03	Butylbenzene, sec- Butylbenzene, tert- Cacodylic Acid	135-98-8 98-06-6 75-60-5					2.30E+04 2.30E+04 4.70E+03	1.70E+04		2.30E+04 2.30E+04 3.70E+03
		1.80E-03 1.80E-03 5.00E-01	I I C	1.00E-03 5.00E-04 C	I I C	1.00E-05 1.00E-05 C	A A C		0.025 0.05 0.025	0.001 0.001		1.36E+09		Cadmium (Diet) Cadmium (Water) Calcium Chromate	7440-43-9 7440-43-9 13765-19-0			2.10E+05	2.10E+05	2.30E+02 2.30E+02 4.70E+03	2.20E+03	4.30E+04	2.10E+02 2.10E+02 4.70E+03
1.50E-01 2.30E-03	C C	4.30E-05 6.60E-07	C C	2.00E-03 1.30E-01	P I		V		1 1	0.1	1.08E+02	1.36E+09	8.14E+03	Caprolactam Captafol Captan	105-60-2 2425-06-1 133-06-2	4.60E+02 3.00E+04	1.50E+03 9.90E+04	8.90E+06 5.80E+08	3.60E+02 2.30E+04	1.20E+05 4.70E+02 3.10E+04	4.40E+05 1.70E+03 1.10E+05	9.40E+06	9.20E+04 3.70E+02 2.40E+04
				1.00E-01 5.00E-03 1.00E-01	I I I	7.00E-01	I	V	1 1 1	0.1	7.38E+02	1.36E+09	1.17E+03	Carbaryl Carbofuran Carbon Disulfide	63-25-2 1563-66-2 75-15-0					2.30E+04 1.20E+03 2.30E+04	8.70E+04 4.40E+03		1.80E+04 9.20E+02 2.30E+03
7.00E-02	I	6.00E-06	I			1.00E-01	I	V	1		4.58E+02	1.36E+09	1.49E+03	Carbon Tetrachloride Carbosulfan Carboxin	56-23-5 55285-14-8 5234-68-4	9.90E+02		7.00E+01	6.50E+01	9.40E+02 2.30E+03 2.30E+04	4.70E+02 8.70E+03 8.70E+04	4.70E+02	3.10E+02 1.80E+03 1.80E+04
				1.00E-01 1.50E-02	I I	9.00E-04	I		1 1	0.1		1.36E+09		Ceric oxide Chloral Hydrate Chloramben	1306-38-3 302-17-0 133-90-4					2.30E+04 3.50E+03	8.70E+04 1.30E+04	3.80E+06	3.80E+06 1.80E+04 2.80E+03
4.00E-01 3.50E-01 1.00E+01	H I I	1.00E-04 4.60E-03	I C	5.00E-04 3.00E-04	I I	7.00E-04	I		1 1	0.04 0.1		1.36E+09 1.36E+09		Chloranil Chlordane Chlordecone (Kepone)	118-75-2 12789-03-6 143-50-0	1.70E+02 2.00E+02 7.00E+00	5.60E+02 1.60E+03 2.30E+01	3.80E+06 8.30E+04	1.30E+02 1.80E+02 5.30E+00	1.20E+02 7.00E+01 1.20E+02	1.10E+03 2.60E+02	3.00E+06	1.10E+02 5.50E+01
				7.00E-04 2.00E-02 1.00E-01	A I I				1 1 1	0.1		1.36E+09 1.36E+09 1.36E+09		Chlorfenvinphos Chlorimuron, Ethyl- Chlorine	470-90-6 90982-32-4 7782-50-5					1.60E+02 4.70E+03 2.30E+04	6.10E+02 1.70E+04		1.30E+02 3.70E+03 2.30E+04
				3.00E-02 3.00E-02	I I	2.00E-04	I		1 1			1.36E+09 1.36E+09		Chlorine Dioxide Chlorite (Sodium Salt) Chloro-1,1-difluoroethane, 1-	10049-04-4 7758-19-2 75-68-3					7.00E+03 7.00E+03	8.50E+05		7.00E+03 7.00E+03
4.60E-01 1.00E-01	H P	7.70E-05 C	I C	2.00E-02 3.00E-03	H X	2.00E-02	I	V	1 1	0.1	7.51E+02	1.36E+09	1.08E+03	Chloro-1,3-bis(4-chlorophenyl)-2- Chloro-2-methylaniline HCl, 4- Chloro-2-methylaniline, 4-	120-89-9 3165-93-3 95-69-2	1.50E+02 7.00E+02	4.90E+02 2.30E+03	1.00E+00 5.00E+06	1.00E+00 5.30E+02	4.70E+03 7.00E+02		6.70E+01	6.70E+01
2.70E-01	X			2.00E-03	H				1	0.1	2.83E+04	1.36E+09	1.86E+04	Chloroacetaldehyde, 2- Chloroacetic Acid Chloroacetophenone, 2-	107-20-0 79-11-8 532-27-4	2.60E+02	8.40E+02		2.00E+02	4.70E+02	1.70E+03		3.70E+02 1.30E+05
2.00E-01 1.10E-01	P C	6.90E-04 C		4.00E-03 2.00E-02	I I	5.00E-02	P	V	1 1	0.1	7.61E+02	1.36E+09	6.45E+03	Chloroaniline, p- Chlorobenzene Chlorobenzilate	106-47-8 108-90-7 510-15-6	3.50E+02 6.30E+02	1.10E+03 2.10E+03		2.70E+02 4.80E+02	9.40E+02 4.70E+03 4.70E+03	3.50E+03 1.00E+03		7.40E+02 8.30E+02 3.70E+03
				3.00E-02 3.00E-03 4.00E-02	X P P		V V		1 1 1	0.1	1.17E+02 7.28E+02	1.36E+09 1.36E+09	6.76E+03 1.76E+03	Chlorobenzoic Acid, p- Chlorobenzotrifluoride, 4- Chlorobutane, 1-	74-11-3 98-56-6 109-69-3					7.00E+02 7.00E+02 9.40E+03	2.60E+04	6.30E+03	5.50E+03 6.30E+02 9.40E+03
				5.00E+01	I	V			1		1.68E+03	1.36E+09	9.38E+02	Chlorodifluoromethane Chloroethanol, 2- Chloroform	75-45-6 107-07-3 67-66-3					4.70E+03 2.30E+03	1.70E+04		1.50E+05 3.70E+03 6.00E+02
3.10E-02	C	2.30E-05	I	1.00E-02	I	9.80E-02	A	V	1	0.1	2.54E+03	1.36E+09	2.63E+03	Chloromethane Chloromethyl Methyl Ether Chloronitrobenzene, o-	74-87-3 107-30-2 88-73-3	2.20E+03		3.20E+01	3.20E+01	4.70E+03 2.30E+03		8.00E+02	3.30E+02 3.30E+02
2.40E+00 3.00E-01	C P	6.90E-04 C		3.00E-03	P	1.00E-05	X		1	0.1	2.58E+04	1.36E+09	5.33E+03	Chloromethyl Methyl Ether Chloronitrobenzene, o- Chloronitrobenzene, p-	107-30-2 88-73-3 100-00-5	2.90E+01 2.30E+02	7.60E+02	2.20E+00	2.00E+00 1.80E+02	7.00E+02 2.60E+03	4.30E+04	5.50E+02	
6.30E-03	P			1.00E-03 5.00E-03	P I	6.00E-04	P		1	0.1	2.19E+04 6.17E+02	1.36E+09 1.36E+09	1.24E+05 4.68E+03	Chloronitrobenzene, p- Chlorophenol, 2- Chloropiricin	100-00-5 95-57-8 76-06-2	1.10E+04	3.60E+04		8.50E+03	2.30E+02 1.20E+03	8.70E+02	2.60E+06	1.80E+02 1.20E+03 5.90E+00
3.10E-03	C	8.90E-07	C	1.50E-02 2.00E-02 2.00E-02	I I X		V V		1 1 1	0.1	9.07E+02 2.53E+02	1.36E+09 1.36E+09	8.12E+03 7.29E+03	Chlorothalonil Chlorotoluene, o- Chlorotoluene, p-	1897-45-6 95-49-8 106-43-4	2.20E+04	7.30E+04	4.30E+08	1.70E+04	3.50E+03 4.70E+03 4.70E+03	1.30E+04		2.80E+03 4.70E+03 4.70E+03

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; J = New Jersey; O = EPA Office of Water; F = See FAQ; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; \* = where: n SL < 100X c SL; \*\* = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information													Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Child Hazard Index (HI) = 3				
SFO (mg/kg-day) <sup>-1</sup>	k e y	IUR (ug/m <sup>3</sup> ) <sup>-1</sup>	k e y	RfD <sub>o</sub> (mg/kg-day)	k e y	RfC <sub>i</sub> (mg/m <sup>3</sup> )	k e y	muta- gen	GIABS	ABS	C <sub>sat</sub> (mg/kg)	PEF (m <sup>3</sup> /kg)	VF (m <sup>3</sup> /kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-4 (mg/kg)	Dermal SL TR=1.0E-4 (mg/kg)	Inhalation SL TR=1.0E-4 (mg/kg)	Carcinogenic SL TR=1.0E-4 (mg/kg)	Ingestion SL Child HQ=3 (mg/kg)	Dermal SL Child HQ=3 (mg/kg)	Inhalation SL Child HQ=3 (mg/kg)	Noncarcinogenic SL Child HI=3 (mg/kg)
2.40E+02	C	6.90E-02	C	2.00E-01 1.00E-03	I A					1 1 1	0.1 0.1 0.1			Chlorozotocin Chlorpropham Chlorpyrifos	54749-90-5 101-21-3 2921-88-2	2.90E-01	9.50E-01	5.50E+03	2.20E-01	4.70E+04 2.30E+02	1.70E+05 8.70E+02		3.70E+04 1.80E+02
				1.00E-02 5.00E-02 8.00E-04	H H H					1 1 1	0.1 0.1 0.1			Chlorpyrifos Methyl Chlorsulfuron Chlorthiophos	5598-13-0 64902-72-3 60238-56-4					2.30E+03 1.20E+04 1.90E+02	8.70E+03 4.40E+04 7.00E+02		1.80E+03 9.20E+03 1.50E+02
5.00E-01	J	8.40E-02	S	1.50E+00 3.00E-03	I I	1.00E-04	I	M		0.013 0.025 0.013				Chromium(III), Insoluble Salts Chromium(VI) Chromium, Total	16065-83-1 18540-29-9 7440-47-3	3.10E+01		1.60E+03	3.00E+01	3.50E+05 7.00E+02		4.30E+05	3.50E+05 7.00E+02
		9.00E-03 6.20E-04	P I	3.00E-04 4.00E-02	P H	6.00E-06	P	M		1 1 1		0.1		Cobalt Coke Oven Emissions Copper	7440-48-4 8007-45-2 7440-50-8			4.20E+04	4.20E+04	7.00E+01 9.40E+03		2.60E+04	7.00E+01 9.40E+03
				5.00E-02 5.00E-02 1.00E-01	I I A	6.00E-01	C			1 1 1	0.1 0.1 0.1			Cresol, m- Cresol, o- Cresol, p-	108-39-4 95-48-7 106-44-5					1.20E+04 1.20E+04 2.30E+04	4.40E+04 4.40E+04 8.70E+04	2.60E+09 2.60E+09 2.60E+09	9.20E+03 9.20E+03 1.80E+04
				1.00E-01 1.00E-01 1.00E-03	A A P	6.00E-01	C			1 1 1	0.1 0.1 0.1			Cresol, p-chloro-m- Cresols Crotonaldehyde, trans-	59-50-7 1319-77-3 123-73-9					2.30E+04 2.30E+04 2.30E+02	8.70E+04 8.70E+04	2.60E+09	1.80E+04 1.80E+04 2.30E+02
1.90E+00	H			1.00E-01	I	4.00E-01	I	V		1	1.66E+04	1.36E+09	1.89E+04	Cumene Cupferron Cyanazine	98-82-8 135-20-6 21725-46-2	3.70E+01			3.70E+01	2.30E+02		7.80E+03	5.80E+03
2.20E-01 8.40E-01	C H	6.30E-05	C	2.00E-03	H					1 1	0.1 0.1			Cyanides ~Calcium Cyanide ~Copper Cyanide	592-01-8 544-92-3	3.20E+02 8.30E+01	1.00E+03 2.70E+02	6.10E+06	2.40E+02 6.30E+01	4.70E+02 1.70E+03		3.70E+02	
				1.00E-03 5.00E-03	I I					1 1		1.36E+09 1.36E+09		Cyanides ~Cyanide (CN-) ~Cyanogen Cyanogen Dromide	592-01-8 544-92-3 57-12-5 460-19-5 506-08-3					2.30E+02 1.20E+03		1.20E+02	2.30E+02 2.10E+04
				1.00E-03 9.00E-02	I I					1 1		1.36E+09 1.36E+09		~Cyanogen Chloride ~Hydrogen Cyanide ~Potassium Cyanide	506-77-4 74-90-8 151-50-8					1.20E+04 1.40E+02 4.70E+02		1.30E+02	1.20E+04 6.80E+01 4.70E+02
				5.00E-03 1.00E-01 1.00E-03	I I I					0.04 0.04 1		1.36E+09 1.36E+09 1.36E+09		~Potassium Silver Cyanide ~Silver Cyanide ~Sodium Cyanide	506-61-6 506-64-9 143-33-9					1.20E+03 2.30E+04 2.30E+02			1.20E+03 2.30E+04 2.30E+02
				2.00E-04 2.00E-04 5.00E-02	P X I					1 1 1		1.36E+09 1.36E+09 1.36E+09		~Thiocyanates ~Thiocyanic Acid ~Zinc Cyanide	NA 463-56-9 557-21-1					4.70E+01 4.70E+01 1.20E+04			4.70E+01 4.70E+01 1.20E+04
2.30E-02	H			6.00E+00 5.00E+00	I I	7.00E-01	P			1 1	1.17E+02 0.1	1.36E+09 1.36E+09	1.04E+03	Cyclohexane Cyclohexane, 1,2,3,4,5-pentabromo-6-chloro- Cyclohexanone	110-82-7 87-84-3 108-94-1	3.00E+03	9.90E+03		2.30E+03	1.20E+06 4.40E+06	3.00E+09		9.20E+05
				5.00E-03 2.00E-01 5.00E-03	P I I	1.00E+00	X	V		1 1 1	2.83E+02	1.36E+09 1.36E+09 1.36E+09	1.33E+03	Cyclohexane Cyclohexylamine Cyhalothrin/karate	110-83-8 108-91-8 68085-85-8					1.20E+03 4.70E+04 1.20E+03		4.20E+03	9.20E+02 3.70E+04 9.20E+02
2.40E-01	I	6.90E-05	C	1.00E-02 7.50E-03	I I					1 1 1	0.1 0.1 0.1	1.36E+09 1.36E+09 1.36E+09		Cypermethrin Cyromazine DDD	52315-07-8 66215-27-8 72-54-8	2.90E+02	9.50E+02	5.50E+06	2.20E+02	2.30E+03 1.80E+03	8.70E+03 6.50E+03		1.80E+03 1.40E+03
3.40E-01 3.40E-01	I I	9.70E-05 9.70E-05	C I	5.00E-04 1.00E-02	I I					1 1 1	0.1 0.03 0.1	1.36E+09 1.36E+09 1.36E+09		DDE, p,p'- DDT Dacthal	72-55-9 50-29-3 1861-32-1	2.00E+02 2.00E+02	6.70E+02 2.20E+03	3.90E+06 3.90E+06	1.60E+02 1.90E+02	1.20E+02 2.30E+03	1.50E+03 8.70E+03		1.10E+02 1.80E+03
7.00E-04	I			3.00E-02 7.00E-03 4.00E-05	I I I					1 1 1	0.1 0.1 0.1	1.36E+09 1.36E+09 1.36E+09		Dalapon Decabromodiphenyl ether, 2,2',3,3',4,4',5,5',6,6'-(BDE-209) Demeton	75-99-0 1163-19-5 8065-48-3	9.90E+04	3.30E+05		7.60E+04	7.00E+03 1.60E+03 9.40E+00	2.60E+04 6.10E+03 3.50E+01		5.50E+03 1.30E+03 7.40E+00
1.20E-03 6.10E-02	H I			6.00E-01 7.00E-04	I A					1 1 1	0.1 0.1 0.1	1.36E+09 1.36E+09 1.36E+09		Di(2-ethylhexyl)adipate Diallate Diazinon	103-23-1 2303-16-4 333-41-5	5.80E+04 1.10E+03	1.90E+05 3.70E+03		4.40E+04 8.70E+02	1.40E+05 6.10E+02		1.10E+05 1.30E+02	
8.00E-01	P	6.00E-03	P	1.00E-02 2.00E-04 4.00E-04	X P X					1 1 1	0.1 0.03 0.1	1.36E+09 1.36E+09 1.36E+09	4.10E+05 3.20E+04	Dibenzothioephene Dibromo-3-chloropropane, 1,2- Dibromobenzene, 1,3-	132-65-0 96-12-8 108-36-1	1.90E+01		5.40E-01	5.30E-01	2.30E+03 4.70E+01 9.40E+01		2.00E+01	2.30E+03 1.40E+01 7.40E+01
				1.00E-02 2.00E-02 9.00E-03	I I I					1 1 1	0.1 0.1 0.1	1.36E+09 1.36E+09 1.36E+09		Dibromobenzene, 1,4- Dibromochloromethane Dibromoethane, 1,2-	106-37-6 124-48-1 106-93-4	8.30E+02 3.50E+01	2.70E+03	8.30E+01 4.00E+00	7.30E+01 3.60E+00	2.30E+03 4.70E+03 2.10E+03	8.70E+03 1.70E+04		1.80E+03 3.70E+03 2.20E+02
				1.00E-02 3.00E-04 3.00E-02	H P I	4.00E-03	X	V		1 1 1	0.1 0.1 0.1	1.36E+09 1.36E+09 1.36E+09	5.64E+03	Dibromomethane (Methylene Bromide) Dibutyltin Compounds Dicamba	74-95-3 NA 1918-00-9					2.30E+03 7.00E+01 7.00E+03		7.10E+01	6.90E+01 5.50E+01 5.50E+03
4.20E-03 4.20E-03 4.20E-03	P P P									1 1 1	5.19E+02 5.19E+02 7.60E+02	1.36E+09 1.36E+09 1.36E+09	1.11E+04 1.11E+04 1.11E+04	Dichloro-2-butene, 1,4- Dichloro-2-butene, cis-1,4- Dichloro-2-butene, trans-1,4-	764-41-0 1476-11-5 110-57-6			7.40E-01 7.40E-01 7.40E-01	7.40E-01				
5.00E-02	I			4.00E-03	I					1	0.1	1.36E+09		Dichloroacetic Acid	79-43-6	1.40E+03	4.60E+03		1.10E+03	9.40E+02	3.50E+03		7.40E+02
5.40E-03	C	1.10E-05	C	9.00E-02 7.00E-02	I A	2.00E-01	H	V		1 1	3.76E+02	1.36E+09	1.17E+04	Dichlorobenzene, 1,2- Dichlorobenzene, 1,4-	95-50-1 106-46-7	1.30E+04		2.70E+02	2.60E+02	2.10E+04 1.60E+04		7.30E+03 2.60E+04	5.40E+03 1.00E+04
4.50E-01	I	3.40E-04	C	9.00E-03 2.00E-01	X I	1.00E-01	X	V		1 1	0.1 0.1	1.36E+09 1.36E+09	8.41E+02	Dichlorobenzidine, 3,3'- Dichlorobenzophenone, 4,4'- Dichlorodifluoromethane	91-94-1 90-98-2 75-71-8	1.50E+02	5.10E+02	1.10E+06	1.20E+02	2.10E+03 4.70E+04	7.90E+03		1.70E+03 2.60E+02
5.70E-03 9.10E-02	C I	1.60E-06 2.60E-05	C I	2.00E-01 6.00E-03 5.00E-02	P X I	7.00E-03	P	V		1 1 1	1.69E+03 2.98E+03 1.19E+03	1.36E+09 1.36E+09 1.36E+09	2.08E+03 4.57E+03 1.16E+03	Dichloroethane, 1,1- Dichloroethane, 1,2- Dichloroethylene, 1,1-	75-34-3 107-06-2 75-35-4	1.20E+04 7.60E+02		3.70E+02 4.90E+01	3.60E+02 4.60E+01	4.70E+04 1.40E+03 1.20E+04		4.70E+04 1.00E+02 7.20E+02	4.70E+04 9.40E+01 6.80E+02

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; J = New Jersey; O = EPA Office of Water; F = See FAQ; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; \* = where: n SL < 100X c SL; \*\* = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Child Hazard Index (HI) = 3			
SFO (mg/kg-day) <sup>-1</sup>	k e y	IUR (ug/m <sup>3</sup> ) <sup>-1</sup>	k e y	RfD <sub>o</sub> (mg/kg-day)	k e y	RfC <sub>i</sub> (mg/m <sup>3</sup> )	k e y	muta- gen	GIABS	ABS	C <sub>sat</sub> (mg/kg)	PEF (m <sup>3</sup> /kg)	VF (m <sup>3</sup> /kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-4 (mg/kg)	Dermal SL TR=1.0E-4 (mg/kg)	Inhalation SL TR=1.0E-4 (mg/kg)	Carcinogenic SL TR=1.0E-4 (mg/kg)	Ingestion SL Child HQ=3 (mg/kg)	Dermal SL Child HQ=3 (mg/kg)	Inhalation SL Child HQ=3 (mg/kg)	Noncarcinogenic SL Child HI=3 (mg/kg)
				2.00E-03	I		V		1		2.37E+03	1.36E+09	2.50E+03	Dichloroethylene, 1,2-cis-	156-59-2					4.70E+02			4.70E+02
				2.00E-02	I		V		1		1.67E+03	1.36E+09	2.51E+03	Dichloroethylene, 1,2-trans-	156-60-5					4.70E+03			4.70E+03
				3.00E-03	I				1	0.1		1.36E+09		Dichlorophenol, 2,4-	120-83-2					7.00E+02	2.60E+03		5.50E+02
				1.00E-02	I				1	0.05		1.36E+09		Dichlorophenoxy Acetic Acid, 2,4-	94-75-7					2.30E+03	1.70E+04		2.10E+03
3.60E-02	C	1.00E-05	C	9.00E-02	A	4.00E-03	I	V	1		1.36E+03	1.36E+09	3.79E+03	Dichlorophenoxybutyric Acid, 4-(2,4-	94-82-6					1.90E+03	7.00E+03		1.50E+03
				8.00E-03	I				1	0.1		1.36E+09		Dichloropropane, 1,2-	78-87-5	1.90E+03		1.10E+02	1.00E+02	2.10E+04		4.70E+01	4.70E+01
				2.00E-02	P		V		1		1.49E+03	1.36E+09	6.76E+03	Dichloropropane, 1,3-	142-28-9					4.70E+03			4.70E+03
				3.00E-03	I				1	0.1		1.36E+09		Dichloropropanol, 2,3-	616-23-9					7.00E+02	2.60E+03		5.50E+02
1.00E-01	I	4.00E-06	I	3.00E-02	I	2.00E-02	I	V	1		1.57E+03	1.36E+09	3.55E+03	Dichloropropane, 1,3-	542-75-6	7.00E+02		2.50E+02	1.80E+02	7.00E+03		2.20E+02	2.20E+02
2.90E-01	I	8.30E-05	C	5.00E-04	I	5.00E-04	I		1	0.1		1.36E+09		Dieldrin	542-75-6	2.40E+02	7.80E+02	4.60E+06	1.80E+02	1.20E+02	4.40E+02	2.10E+06	9.20E+01
				8.00E-02	P	3.00E-04	X	V	1			1.36E+09	4.11E+03	Dicyclopentadiene	77-73-6					1.90E+04		3.90E+00	3.90E+00
1.60E+01	I	4.60E-03	I	5.00E-05	I				1	0.1		1.36E+09		Dieldrin	60-57-1	4.30E+00	1.40E+01	8.30E+04	3.30E+00	1.20E+01	4.40E+01		9.20E+00
				3.00E-04	C				1	0.1				Diethylstilbestrol	56-53-1					2.00E-01	6.50E-01	3.80E+03	1.50E-01
				2.00E-03	P	2.00E-04	P		1	0.1		1.36E+09		Diethanolamine	111-42-2					4.70E+02	1.70E+03	8.50E+05	3.70E+02
				3.00E-02	P	1.00E-04	P		1	0.1		1.36E+09		Diethylene Glycol Monobutyl Ether	112-34-5					7.00E+03	2.60E+04	4.30E+05	5.50E+03
				6.00E-02	P	3.00E-04	P		1	0.1		1.36E+09		Diethylene Glycol Monoethyl Ether	111-90-0					1.40E+04	5.20E+04	1.30E+06	1.10E+04
3.50E+02	C	1.00E-01	C	1.00E-03	P				1	0.1		1.36E+09		Diethylformamide	617-84-5					2.30E+02	8.70E+02		1.80E+02
				8.00E-02	I				1	0.1		1.36E+09		Difluoromethane, 1,1-	56-53-1					4.70E+03	1.70E+04		1.40E+05
				2.00E-02	I				1	0.1		1.36E+09		Difluoromethane, 1,1-	35367-38-5					4.70E+03	1.70E+04		1.40E+05
				4.00E+01	I	V			1		1.43E+03	1.36E+09	1.15E+03	Difluoromethane, 1,1-	75-37-6								
4.40E-02	C	1.30E-05	C	8.00E-02	I				1	0.1		1.36E+09	1.24E+03	Dihydroarsafrole	43222-48-6	1.60E+03	5.20E+03	2.70E+01	2.60E+01	1.90E+04		6.70E+03	6.70E+03
				7.00E-01	P	V			1		2.26E+03	1.36E+09	3.06E+03	Diisopropyl Ether	108-20-3								1.90E+04
				5.30E+02	I	V			1		5.30E+02	1.36E+09	2.87E+04	Diisopropyl Methylphosphonate	1445-75-6								3.70E+03
				2.00E-02	I				1	0.1		1.36E+09		Dimethipin	55290-64-7					4.70E+03	1.70E+04		3.70E+03
				2.00E-04	I				1	0.1		1.36E+09		Dimethoate	60-51-5					4.70E+01	1.70E+02		3.70E+01
1.60E+00	P			6.00E-02	P				1	0.1		1.36E+09		Dimethoxybenzidine, 3,3'-	119-90-4	4.30E+01	1.40E+02		3.30E+01				
1.70E-03	P			4.60E+00	C	1.30E-03	C		1	0.1		1.36E+09		Dimethyl methylphosphonate	756-79-6	4.10E+04	1.30E+05		3.10E+04	1.40E+04	5.20E+04		1.10E+04
5.80E-01	H			2.00E-01	P				1	0.1		1.36E+09		Dimethylamino azobenzene [p-]	60-11-7	1.50E+01	4.90E+01	2.90E+05	1.20E+01				
				2.00E-01	P				1	0.1		1.36E+09		Dimethylaniline HCl, 2,4-	21436-96-4	1.20E+02	3.90E+02		9.20E+01				
				2.00E-01	P				1	0.1		1.36E+09		Dimethylaniline, 2,4-	95-68-1	3.50E+02	1.10E+03		2.70E+02	4.70E+02	1.70E+03		3.70E+02
1.10E+01	P			2.00E-03	I		V		1		8.30E+02	1.36E+09	3.13E+04	Dimethylaniline, N,N-	121-69-7	6.30E+00	2.10E+01		4.80E+00	4.70E+02			4.70E+02
				1.00E-01	P	3.00E-02	I		1	0.1		1.36E+09		Dimethylbenzidine, 3,3'-	119-93-7								
				1.00E-04	X	2.00E-06	X		1	0.1		1.36E+09		Dimethylformamide	68-12-2					2.30E+04	8.70E+04	1.30E+08	1.80E+04
5.50E+02	C	1.60E-01	C	1.00E-04	X				1	0.1		1.36E+09		Dimethylhydrazine, 1,1-	57-14-7	2.30E+01	8.70E+01			2.30E+01	8.70E+01	8.50E+03	1.80E+01
				2.00E-02	I				1	0.1		1.36E+09		Dimethylhydrazine, 1,2-	540-73-8	1.30E-01	4.10E-01	2.40E+03	9.70E-02				
				6.00E-04	I				1	0.1		1.36E+09		Dimethylphenol, 2,4-	105-67-9					4.70E+03	1.70E+04		3.70E+03
				1.00E-03	I				1	0.1		1.36E+09		Dimethylphenol, 2,6-	576-26-1					1.40E+02	5.20E+02		1.10E+02
				1.00E-03	I				1	0.1		1.36E+09		Dimethylphenol, 3,4-	95-65-8					2.30E+02	8.70E+02		1.80E+02
4.50E-02	C	1.30E-05	C	8.00E-05	X				1	0.1	1.09E+03	1.36E+09	1.01E+03	Dimethylvinylchloride	513-37-1	1.50E+03	5.10E+03	2.20E+01	2.10E+01	1.90E+01	7.00E+01		1.50E+01
				2.00E-03	I				1	0.1		1.36E+09		Dinitro-o-cresol, 4,6-	534-52-1					4.70E+02	1.70E+03		3.70E+02
				2.00E-03	I				1	0.1		1.36E+09		Dinitro-o-cyclohexyl Phenol, 4,6-	131-89-5								
				1.00E-04	P				1	0.1		1.36E+09		Dinitrobenzene, 1,2-	528-29-0					2.30E+01	8.70E+01		1.80E+01
				1.00E-04	P				1	0.1		1.36E+09		Dinitrobenzene, 1,3-	99-65-0					2.30E+01	8.70E+01		1.80E+01
				1.00E-04	P				1	0.1		1.36E+09		Dinitrobenzene, 1,4-	100-25-4					2.30E+01	8.70E+01		1.80E+01
				2.00E-03	I				1	0.1		1.36E+09		Dinitrophenol, 2,4-	51-28-5					4.70E+02	1.70E+03		3.70E+02
6.80E-01	I			3.10E-01	C	8.90E-05	C		1	0.1		1.36E+09		Dinitrotoluene Mixture, 2,4/2,6-	NA	1.00E+02	3.30E+02		7.80E+01	4.70E+02	1.70E+03		3.70E+02
1.50E+00	P			3.00E-04	X				1	0.099		1.36E+09		Dinitrotoluene, 2,6-	121-14-2	2.20E+02	7.20E+02	4.30E+06	1.70E+02	4.70E+02	1.70E+03		3.70E+02
				2.00E-03	S				1	0.006		1.36E+09		Dinitrotoluene, 2-Amino-4,6-	606-20-2	4.60E+01	1.50E+02		3.60E+01	7.00E+01	2.60E+02		5.60E+01
				2.00E-03	S				1	0.009		1.36E+09		Dinitrotoluene, 4-Amino-2,6-	35572-78-2					4.70E+02	2.90E+04		4.60E+02
4.50E-01	X			9.00E-04	X				1	0.1		1.36E+09		Dinitrotoluene, Technical grade	19406-51-0					4.70E+02	1.90E+04		4.60E+02
				1.00E-03	I				1	0.1		1.36E+09		Dinitrotoluene, 2,4-	25321-14-6	1.50E+02	5.10E+02		1.20E+02	2.10E+02	7.90E+02		1.70E+02
1.00E-01	I	5.00E-06	I	3.00E-02	I	3.00E-02	I		1	0.1		1.36E+09		Dinoseb	88-85-7								



Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; J = New Jersey; O = EPA Office of Water; F = See FAQ; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; \* = where: n SL < 100X c SL; \*\* = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Child Hazard Index (HI) = 3			
SFO (mg/kg-day) <sup>-1</sup>	k <sub>e</sub> y	IUR (ug/m <sup>3</sup> ) <sup>-1</sup>	k <sub>e</sub> y	RfD <sub>c</sub> (mg/kg-day)	k <sub>e</sub> y	RfC <sub>c</sub> (mg/m <sup>3</sup> )	k <sub>e</sub> y	muta- gen	GIABS	ABS	C <sub>sat</sub> (mg/kg)	PEF (m <sup>3</sup> /kg)	VF (m <sup>3</sup> /kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-4 (mg/kg)	Dermal SL TR=1.0E-4 (mg/kg)	Inhalation SL TR=1.0E-4 (mg/kg)	Carcinogenic SL TR=1.0E-4 (mg/kg)	Ingestion SL Child HQ=3 (mg/kg)	Dermal SL Child HQ=3 (mg/kg)	Inhalation SL Child HQ=3 (mg/kg)	Noncarcinogenic SL Child HI=3 (mg/kg)
				5.00E-03 5.00E-04 1.00E-01						1 1 1	0.1 0.1 0.1			Ethephon Ethion Ethoxyethanol Acetate, 2-	16672-87-0 563-12-2 111-15-9					1.20E+03 1.20E+02 2.30E+04	4.40E+03 4.40E+02 8.70E+04		9.20E+02 9.20E+01 1.80E+04
				9.00E-02 9.00E-01 5.00E-03	P I P	2.00E-01 7.00E-02 8.00E-03	I P V			1 1 1	0.1 0.1 0.1			Ethoxyethanol, 2- Ethyl Acetate Ethyl Acrylate	110-80-5 141-78-6 140-88-5					2.10E+04 2.10E+05 1.20E+03	7.90E+04 8.50E+08 1.90E+03	8.50E+08 1.90E+03 1.60E+02	1.70E+04 1.90E+03 1.40E+02
4.80E-02	H													Ethyl Chloride (Chloroethane) Ethyl Ether Ethyl Methacrylate	75-00-3 60-29-7 97-63-2	1.40E+03			1.40E+03	4.70E+04 2.10E+04			4.10E+04 4.70E+04 4.30E+03
				1.00E-05 1.00E-01 7.00E-02	I I P					1 1 1	0.1 0.1 0.1			Ethyl-p-nitrophenyl Phosphonate Ethylbenzene Ethylene Cyanohydrin	2104-64-5 100-41-4 109-78-4	6.30E+03		6.40E+02	5.80E+02	2.30E+00 2.30E+04 1.60E+04	8.70E+00 1.80E+04 6.10E+04		1.80E+04 1.00E+04 1.30E+04
				9.00E-02 2.00E+00 1.00E-01	P I I					1 1 1	0.1 0.1 0.1			Ethylene Diamine Ethylene Glycol Ethylene Glycol Monobutyl Ether	107-15-3 107-21-1 111-76-2					2.10E+04 4.70E+05 2.30E+04	7.90E+04 1.70E+06 8.70E+04	7.90E+04 1.70E+09 6.80E+09	1.70E+04 3.70E+05 1.80E+04
3.10E-01 4.50E-02 6.50E+01	C C C	8.80E-05 1.30E-05 1.90E-02	C C C			3.00E-02 8.00E-05	C I			1 1	0.1 0.1			Ethylene Oxide Ethylene Thiourea Ethyleneimine	75-21-8 96-45-7 151-56-4	2.20E+02 1.50E+03 1.10E+00		1.90E+01 2.90E+07 3.50E-01	1.80E+01 1.20E+03 2.50E-01	1.90E+01 7.00E+01		5.70E+02	5.70E+02 1.50E+01
				3.00E+00 8.00E-03 2.50E-04	I I I					1 1 1	0.1 0.1 0.1			Ethylphthalyl Ethyl Glycolate Express Fenamiphos	84-72-0 101200-48-0 22224-92-6					7.00E+05 1.90E+03 5.90E+01	2.60E+06 7.00E+03 2.20E+02		5.50E+05 1.50E+03 4.60E+01
				2.50E-02 1.30E-02 4.00E-02	I I C					1 1 1	0.1 0.1 0.1			Fenpropatrin Fluometuron Fluoride	39515-41-8 2164-17-2 16984-48-8					5.90E+03 3.10E+03 9.40E+03	2.20E+04 1.10E+04		4.60E+03 2.40E+03 9.40E+03
				6.00E-02 8.00E-02 2.00E-02	I I I	1.30E-02	C			1 1 1	0.1 0.1 0.1			Fluorine (Soluble Fluoride) Fluridone Flurprimidol	7782-41-4 59756-60-4 56425-91-3					1.40E+04 1.90E+04 4.70E+03	7.00E+04		1.40E+04 1.50E+04 3.70E+03
				6.00E-02 1.00E-02 1.00E-01	I I I					1 1 1	0.1 0.1 0.1			Flutolanil Fluxalinate Folpet	66332-96-5 69409-94-5 133-07-3					1.40E+04 2.30E+03 2.30E+04	5.20E+04 8.70E+03 8.70E+04		1.10E+04 1.80E+03 1.80E+04
3.50E-03 1.90E-01	I I									1 1	0.1 0.1			Fomesafen Fonofos Formaldehyde	72178-02-0 944-22-9 50-00-0	2.00E+04 3.70E+02	6.50E+04 1.20E+03		1.50E+04 2.80E+02				
		1.30E-05	I	2.00E-03 2.00E-01	I I					1 1	0.1 0.1			Formic Acid Fosetyl-AL Furans	64-18-6 39148-24-8					4.70E+02 4.70E+04 2.10E+05	1.70E+03 1.70E+05 7.90E+05	4.20E+07	3.70E+02 3.70E+04 1.50E+05
				9.00E-01 3.00E+00	P I	3.00E-04	X			1 1	0.1 0.1									7.00E+05 2.60E+06		1.30E+06	5.50E+05
				1.00E-03 9.00E-03 9.00E-01	X I I					1 1 1	0.03 0.03 0.03			~Dibenzofuran ~Furan ~Tetrahydrofuran	132-64-9 110-00-9 109-99-9					2.30E+02 2.30E+02 2.10E+05	2.90E+03 2.90E+03 2.60E+06		2.20E+02 2.20E+02 5.50E+04
3.80E+00	H									1	0.1			Furazolidone Furfural Furium	67-45-8 98-01-1 631-82-8	1.80E+01 4.60E+01	6.00E+01 1.50E+02		1.40E+01 3.60E+01	7.00E+02	2.60E+03	2.10E+08	5.50E+02
1.50E+00 3.00E-02	C I	4.30E-04 8.60E-06	C C							1 1	0.1 0.1			Furmecyclo-x Glufosinate, Ammonium Glutaraldehyde	60568-05-0 77182-82-2 111-30-8	2.30E+03	7.60E+03	4.40E+07	1.80E+03	9.40E+01	3.50E+02		7.40E+01 3.40E+05
				4.00E-04	I					1	0.1												
				4.00E-04 1.00E-01 3.00E-03	I I I	1.00E-03	H			1 1 1	0.1 0.1 0.1			Glycidyl Glyphosate Goal	765-34-4 1071-83-6 42874-03-3					9.40E+01 2.30E+04 7.00E+02	3.50E+02 8.70E+04 2.60E+03	4.30E+06	7.40E+01 1.80E+04 5.50E+02
				1.00E-02 2.00E-02 3.00E-03	X P C					1 1 1	0.1 0.1 0.1			Guanidine Guanidine Chloride Guthion	113-00-8 50-01-1 86-50-0					2.30E+03 4.70E+03 7.00E+02	8.70E+03 1.70E+04 2.60E+03	4.30E+07	1.80E+03 3.70E+03 5.50E+02
				5.00E-05 1.30E-02 5.00E-04	I I I					1 1 1	0.1 0.1 0.1			Haloxypol, Methyl Harmony Heptachlor	69806-40-2 79277-27-3 76-44-8					1.20E+01 3.10E+03 1.20E+02	4.40E+01 1.10E+04 4.40E+02		9.20E+00 2.40E+03 9.20E+01
9.10E+00	I	2.60E-03	I							1	0.1			Heptachlor Epoxide Hexabromobenzene Hexabromodiphenyl ether, 2,2',4,4',5,5'- (BDE-153)	1024-57-3 87-82-1 68631-49-2	7.60E+00	2.50E+01	1.50E+05	5.90E+00	3.10E+00 4.70E+02 4.70E+01	1.10E+01 1.70E+03 1.70E+02		2.40E+00 3.70E+02 3.70E+01
1.60E+00 7.80E-02 6.30E+00	I I I	4.60E-04 2.20E-05 1.80E-03	I P A							1 1 1	0.1 0.1 0.1			Hexachlorobenzene Hexachlorobutadiene Hexachlorocyclohexane, Alpha-	118-74-1 87-68-3 319-84-6	4.30E+01 8.90E+02 1.10E+01	1.40E+02 2.90E+03 3.60E+01	8.30E+05 1.70E+07 2.10E+05	3.30E+01 6.80E+02 8.50E+00	1.90E+02 2.30E+02 1.90E+03	7.00E+02 8.70E+02 7.00E+03		1.50E+02 1.80E+02 1.50E+03
1.80E+00 1.10E+00 1.80E+00	I C I	5.30E-04 3.10E-04 5.10E-04	I C I							1 1 1	0.1 0.04 0.1			Hexachlorocyclohexane, Beta- Hexachlorocyclohexane, Gamma- (Lindane) Hexachlorocyclohexane, Technical	319-85-7 58-89-9 608-73-1	3.90E+01 6.30E+01 3.90E+01	1.30E+02 5.20E+02 1.30E+02	7.20E+05 1.20E+06 7.50E+05	3.00E+01 5.60E+01 3.00E+01	7.00E+01	6.50E+02		6.40E+01
				6.00E-03 7.00E-04 3.00E-04	I I I	2.00E-04 3.00E-02	I I			1 1 1	0.1 0.1 0.1			Hexachlorocyclopentadiene Hexachloroethane Hexachlorophene	77-47-4 67-72-1 70-30-4	1.70E+03	5.70E+03	3.50E+07	1.30E+03	1.40E+03 1.60E+02 7.00E+01	5.20E+03 6.10E+02 2.60E+02	8.50E+05 1.30E+08	1.10E+03 1.30E+02 5.50E+01
1.10E-01	I			3.00E-03 4.00E-04	I P					1 1	0.015 0.1			Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) Hexamethylene Diisocyanate, 1,6- Hexamethylphosphoramide	121-82-4 822-06-0 680-31-9	6.30E+02	1.40E+04		6.00E+02	7.00E+02 9.40E+01	1.70E+04 3.50E+02		6.80E+02 9.40E+00 7.40E+01
				6.00E-02 2.00E+00 5.00E-03	H P I	7.00E-01	I P I			1 1 1	0.1 0.1 0.1			Hexane, N- Hexanedioic Acid Hexanone, 2-	110-54-3 124-04-9 591-78-6					1.40E+04 4.70E+05 1.20E+03		1.80E+03	1.60E+03 3.70E+05 6.00E+02
				3.30E-02	I					1	0.1			Hexazinone	51235-04-2					7.70E+03	2.90E+04		6.10E+03
3.00E+00 3.00E+00	I I	4.90E-03 4.90E-03	I I							1 1	0.1 0.1			Hydrazine Hydrazine Sulfate	302-01-2 10034-93-2	2.30E+01 2.30E+01		7.80E+04 7.80E+04	2.30E+01 2.30E+01			1.30E+05	1.30E+05

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; J = New Jersey; O = EPA Office of Water; F = See FAQ; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; \* = where: n SL < 100X c SL; \*\* = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information											Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Child Hazard Index (HI) = 3			
SFO (mg/kg-day) <sup>-1</sup>	k e y IUR (ug/m <sup>3</sup> ) <sup>-1</sup>	k e y RfD <sub>o</sub> (mg/kg-day)	k e y RfC <sub>i</sub> (mg/m <sup>3</sup> ) <sup>-1</sup>	k e y c o m u t a g e n	GIABS	ABS	C <sub>sat</sub> (mg/kg)	PEF (m <sup>3</sup> /kg)	VF (m <sup>3</sup> /kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-4 (mg/kg)	Dermal SL TR=1.0E-4 (mg/kg)	Inhalation SL TR=1.0E-4 (mg/kg)	Carcinogenic SL TR=1.0E-4 (mg/kg)	Ingestion SL Child HQ=3 (mg/kg)	Dermal SL Child HQ=3 (mg/kg)	Inhalation SL Child HQ=3 (mg/kg)	Noncarcinogenic SL Child HI=3 (mg/kg)	
			2.00E-02 I 4.00E-02 C		1 1 1			1.36E+09 1.36E+09 1.36E+09		Hydrogen Chloride Hydrogen Fluoride Hydrogen Sulfide	7647-01-0 7664-39-3 7783-06-4						9.40E+03		8.50E+07 6.00E+07 8.50E+06	8.50E+07 9.40E+03 8.50E+06
6.00E-02	P		4.00E-02 P 1.30E-02 I 2.50E-01 I		1 1 1	0.1		1.36E+09 1.36E+09 1.36E+09		Hydroquinone Imazalil Imazaquin	123-31-9 35554-44-0 81335-37-7	1.20E+03	3.80E+03		8.90E+02	9.40E+03 3.10E+03 5.90E+04	3.50E+04 1.10E+04 2.20E+05		7.40E+03 2.40E+03 4.60E+04	
			1.00E-02 A 4.00E-02 I 7.00E-01 P		1 1 1		0.1	1.36E+09 1.36E+09 1.36E+09		Iodine Iprodione Iron	7553-56-2 36734-19-7 7439-89-6					2.30E+03 9.40E+03 1.60E+05	3.50E+04		2.30E+03 7.40E+03 1.60E+05	
9.50E-04	I		3.00E-01 I 2.00E-01 I 1.50E-02 I		1 1 1	0.1		1.36E+09 1.36E+09 1.36E+09		Isobutyl Alcohol Isophorone Isopropalin	78-83-1 78-59-1 33820-53-0	7.30E+04	2.40E+05		5.60E+04	7.00E+04 4.70E+04 3.50E+03	2.60E+05 1.70E+05 1.30E+04	8.50E+09	5.50E+04 3.70E+04 2.80E+03	
			2.00E+00 P 1.00E-01 I 5.00E-02 I		1 1 1	0.1		1.36E+09 1.36E+09 1.36E+09		Isopropanol Isopropyl Methyl Phosphonic Acid Isoxaben	67-63-0 1832-54-8 82558-50-7					4.70E+05 2.30E+04 1.20E+04	1.70E+06 8.70E+04 4.40E+04	8.50E+08	3.70E+05 1.80E+04 9.20E+03	
			3.00E-01 A V 7.50E-02 I 2.00E-03 I		1 1 1		0.1	1.36E+09 1.36E+09 1.36E+09		JP-7 Kerb Lactofen	NA 23950-58-5 77501-63-4							1.30E+09	1.30E+09 1.40E+04 3.70E+02	
5.00E-01 8.50E-03	C C	1.50E-01 C 1.20E-05 C	2.00E-02 C 2.00E-04 C	M	0.025			1.36E+09 1.36E+09		<b>Lead Compounds</b> ~Lead Chromate ~Lead Phosphate	7758-97-6 7446-27-7	3.10E+01 8.20E+03		9.20E+02 3.20E+07	3.00E+01 8.20E+03	4.70E+03		8.50E+05	4.70E+03	
2.80E-01 8.50E-03	C C	8.00E-05 C 1.20E-05 C				0.1		1.36E+09 1.36E+09 1.36E+09		~Lead acetate ~Lead and Compounds ~Lead subacetate	301-04-2 7439-92-1 1335-32-6	2.50E+02 8.10E+02	8.40E+06	1.90E+02					4.00E+02	
			1.00E-07 I 2.00E-03 I 2.00E-03 P		1 1 1	0.1		1.36E+09 1.36E+09 1.36E+09		~Tetraethyl Lead Linuron Lithium	78-00-2 330-55-2 7439-93-2					2.30E-02 4.70E+02 4.70E+02	8.70E-02 1.70E+03		1.80E-02 3.70E+02 4.70E+02	
			2.00E-01 I 5.00E-04 I 1.00E-02 I		1 1 1	0.1		1.36E+09 1.36E+09 1.36E+09		Londax MCPA MCPB	83055-99-6 94-74-6 94-81-5					4.70E+04 1.20E+02 2.30E+03	1.70E+05 4.40E+02 8.70E+03		3.70E+04 9.20E+01 1.80E+03	
			1.00E-03 I 2.00E-02 I 1.00E-01 I		1 1 1	0.1		1.36E+09 1.36E+09 1.36E+09		MCPP Malathion Maleic Anhydride	93-65-2 121-75-5 108-31-6					2.30E+02 4.70E+03 2.30E+04	8.70E+02 1.70E+04 8.70E+04	3.00E+06	1.80E+02 3.70E+03 1.80E+04	
			5.00E-01 I 1.00E-04 P 3.00E-02 H		1 1 1	0.1		1.36E+09 1.36E+09 1.36E+09		Maleic Hydrazide Malononitrile Mancozeb	123-33-1 109-77-3 8018-01-7					1.20E+05 2.30E+01 7.00E+03	4.40E+05 8.70E+01 2.60E+04		9.20E+04 1.80E+01 5.50E+03	
			5.00E-03 I 1.40E-01 I 2.40E-02 S		1 1 0.04			1.36E+09 1.36E+09 1.36E+09		Maneb Manganese (Diet) Manganese (Non-diet)	12427-38-2 7439-96-5 7439-96-5					1.20E+03 5.60E+03	4.40E+03		9.20E+02 5.50E+03	
			9.00E-05 H 3.00E-02 I		1 1	0.1		1.36E+09 1.36E+09		Mephosfolan Mepiquat Chloride	950-10-7 24307-26-4					2.10E+01 7.00E+03	7.90E+01 2.60E+04		1.70E+01 5.50E+03	
			3.00E-04 I 1.00E-04 I		1 1		3.13E+00	1.36E+09 1.36E+09	3.01E+04	~Mercuric Chloride (and other Mercury salts) ~Mercury (elemental) ~Methyl Mercury	7487-84-7 7439-97-6 22967-92-6					7.00E+01 2.30E+01		1.30E+06 2.80E+01	7.00E+01 2.80E+01 2.30E+01	
			8.00E-05 I 3.00E-05 I 3.00E-05 I		1 1 1	0.1		1.36E+09 1.36E+09 1.36E+09		~Phenylmercuric Acetate Merphos Merphos Oxide	62-38-4 150-50-5 78-48-8					1.90E+01 7.00E+00 7.00E+00	7.00E+01 2.60E+01 2.60E+01		1.50E+01 5.50E+00 5.50E+00	
			6.00E-02 I 1.00E-04 I 5.00E-05 I		1 1 1	0.1	4.58E+03	1.36E+09 1.36E+09 1.36E+09	6.79E+03	Metalaxyl Methacrylonitrile Methamidophos	57837-19-1 126-98-7 10265-92-6					1.40E+04 2.30E+01 1.20E+01	5.20E+04 6.40E+02		1.10E+04 2.30E+01 9.20E+00	
			2.00E+00 I 1.00E-03 I 2.50E-02 I		1 1 1	0.1		1.36E+09 1.36E+09 1.36E+09		Methanol Methidathion Methomyl	67-56-1 950-37-8 16752-77-5					4.70E+05 2.30E+02 5.90E+03	1.70E+06 8.70E+02 2.20E+04	8.50E+10	3.70E+05 1.80E+02 4.60E+03	
4.90E-02	C	1.40E-05 C				0.1		1.36E+09		Methoxy-5-nitroaniline, 2- Methoxychlor Methoxyethanol Acetate, 2- Methoxyethanol, 2- Methyl Acetate Methyl Acrylate	99-59-2 72-43-5 110-49-6 109-86-4 79-20-9 96-33-3	1.40E+03	4.60E+03	2.70E+07	1.10E+03	1.20E+03 1.90E+03 1.20E+03 2.30E+05 7.00E+03	4.40E+03 7.00E+03 4.40E+03	8.50E+07	9.20E+02 1.50E+03 9.20E+02 2.30E+05 4.10E+02	
			6.00E-01 I 1.00E-03 X 8.00E-02 H		1 1 1		2.84E+04 3.36E+03	1.36E+09 1.36E+09 1.36E+09	1.22E+04 1.06E+04	Methyl Ethyl Ketone (2-Butanone) Methyl Hydrazine Methyl Isobutyl Ketone (4-methyl-2-pentanone)	78-93-3 60-34-4 108-10-1			3.80E+05	3.80E+05	1.40E+05 2.30E+02 1.90E+04	1.90E+05 8.70E+02		8.10E+04 1.80E+02 1.60E+04	
			1.00E-03 C V 1.40E+00 I 2.50E-04 I		1 1 1	0.1	1.67E+04 2.36E+03	1.36E+09 1.36E+09 1.36E+09	4.42E+03 6.33E+03	Methyl Isocyanate Methyl Methacrylate Methyl Parathion	624-83-9 80-62-6 298-00-0					3.30E+05 5.90E+01		1.40E+01 1.40E+04	1.40E+01 1.30E+04 4.60E+01	
			6.00E-02 X 6.00E-03 H		1 1	0.1	3.93E+02	1.36E+09 1.36E+09	1.07E+04	Methyl Phosphonic Acid Methyl Styrene (Mixed Isomers) Methyl methanesulfonate	993-13-5 25013-15-4 66-27-3					1.40E+04 1.40E+03	5.20E+04		1.10E+04 6.80E+02	
9.90E-02	C	2.80E-05 C				0.1		1.36E+09		Methyl tert-Butyl Ether (MTBE)	1634-04-4	3.90E+04		5.30E+03	4.70E+03			4.60E+04	4.60E+04	
1.80E-03	C	2.60E-07 C				0.1	8.87E+03	1.36E+09	4.90E+03	Methyl-1,4-benzenediamine dihydrochloride, 2- Methyl-5-Nitroaniline, 2- Methyl-N-nitro-N-nitrosoguanidine, N- Methylaniline Hydrochloride, 2- Methylarsonic acid	615-45-2 99-55-8 70-25-7 636-21-5 124-58-3	3.90E+04 7.70E+03 8.40E+00 5.30E+02		5.30E+03 2.50E+04 2.70E+01 1.80E+03	4.70E+03 5.90E+03		2.60E+02 1.70E+04		5.50E+01 3.70E+03	
8.30E+00 1.30E-01	C C	2.40E-03 C 3.70E-05 C				0.1		1.36E+09 1.36E+09									2.30E+03 8.70E+03		1.80E+03	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; J = New Jersey; O = EPA Office of Water; F = See FAQ; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; \* = where: n SL < 100X c SL; \*\* = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information															Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Child Hazard Index (HI) = 3				
SFO (mg/kg-day) <sup>-1</sup>	k e y	IUR (ug/m <sup>3</sup> ) <sup>-1</sup>	k e y	RfD <sub>c</sub> (mg/kg-day)	k e y	RfC <sub>c</sub> (mg/m <sup>3</sup> )	k e y	o v o l u t i l e	muta- gen	GI/ABS	ABS	C <sub>sat</sub> (mg/kg)	PEF (m <sup>3</sup> /kg)	VF (m <sup>3</sup> /kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-4 (mg/kg)	Dermal SL TR=1.0E-4 (mg/kg)	Inhalation SL TR=1.0E-4 (mg/kg)	Carcinogenic SL TR=1.0E-4 (mg/kg)	Ingestion SL Child HQ=3 (mg/kg)	Dermal SL Child HQ=3 (mg/kg)	Inhalation SL Child HQ=3 (mg/kg)	Noncarcinogenic SL Child HI=3 (mg/kg)	
1.00E-01 2.20E+01	X C	6.30E-03 C	C	2.00E-04 3.00E-04	X X					1 1	0.1 0.1	1.36E+09 1.36E+09			Methylbenzene,1,4-diamine monohydrochloride, 2- Methylbenzene-1,4-diamine sulfate, 2- Methylcholanthrene, 3-	74612-12-7 615-50-9 56-49-5	7.00E+02 7.00E-01	2.30E+03 2.40E+00	2.20E+04 2.20E+04	5.30E+02 5.40E-01	4.70E+01 7.00E+01	1.70E+02 2.60E+02		3.70E+01 5.50E+01	
2.00E-03 1.00E-01 4.60E-02	I P C	1.00E-08 4.30E-04 1.30E-05	C	6.00E-03 2.00E-03	I P	6.00E-01 6.00E-01	I V	M M		1 1	0.1 0.1	3.32E+03 1.36E+09 1.36E+09	2.19E+03 1.36E+09 1.36E+09		Methylene Chloride Methylene-bis(2-chloroaniline), 4,4'- Methylene-bis(N,N-dimethyl) Aniline, 4,4'-	75-09-2 101-14-4 101-61-1	7.70E+03 1.50E+02 1.50E+03	2.20E+04 5.40E+02 4.90E+03	2.20E+05 3.20E+05 2.90E+07	5.70E+03 1.20E+02 1.20E+03	1.40E+03 4.70E+02	1.70E+03	4.10E+03	1.00E+03 3.70E+02	
1.60E+00	C	4.60E-04	C			2.00E-02 6.00E-04	C I			1 1	0.1 0.1	1.36E+09 1.36E+09			Methylenabisbenzenamine, 4,4'- Methylenediphenyl Diisocyanate Methylstyrene, Alpha-	101-77-9 101-68-8 98-83-9	4.30E+01	1.40E+02	8.30E+05	3.30E+01			8.50E+07 2.60E+06	8.50E+07 2.60E+06 1.60E+04	
				7.00E-02	H		V			1		5.00E+02	1.36E+09	1.28E+04							1.60E+04				
				1.50E-01 2.50E-02 3.00E+00	I I P					1 1 1	0.1 0.1 0.1	1.36E+09 1.36E+09 3.42E-01	1.36E+09 1.36E+09 1.36E+09	1.06E+03	Metolachlor Metribuzin Mineral oils	51218-45-2 21087-64-9 8012-95-1					3.50E+04 5.90E+03 7.00E+05	1.30E+05 2.20E+04 2.60E+06		2.80E+04 4.60E+03 5.50E+05	
1.80E+01	C	5.10E-03	C	2.00E-04 2.00E-03 5.00E-03	I I I					1 1 1	0.1 0.1 0.1	1.36E+09 1.36E+09 1.36E+09			Mirex Molinate Molybdenum	2385-85-5 2212-67-1 7439-98-7	3.90E+00	1.30E+01	7.50E+04	3.00E+00	4.70E+01 4.70E+02 1.20E+03	1.70E+02 1.70E+03		3.70E+01 3.70E+02 1.20E+03	
				1.00E-01 2.00E-03 3.00E-04	I P X					1 1 1	0.1 0.1 0.1	1.36E+09 1.36E+09 1.36E+09			Monochloramine Monomethylaniline N,N-Diphenyl-1,4-benzenediamine	10599-90-3 100-61-8 74-31-7					2.30E+04 4.70E+02 7.00E+01	1.70E+03 2.60E+02		2.30E+04 3.70E+02 5.50E+01	
				2.00E-03 3.00E-02	I X	1.00E-01	P V			1 1	0.1 0.1	1.36E+09 1.36E+09			Naled Naphtha, High Flash Aromatic (HFAN) Naphthylamine, 2-	300-76-5 64742-95-6 91-59-8	3.90E+01	1.30E+02		3.00E+01	4.70E+02 7.00E+03	1.70E+03	4.30E+08	3.70E+02 7.00E+03	
				2.60E-04 2.60E-04 2.60E-04	C C C	1.10E-02 1.10E-02 1.10E-02	C C C	1.40E-05 1.40E-05 1.40E-05	C C C	0.04 0.04 0.04		1.36E+09 1.36E+09 1.36E+09			Napropamide Nickel Acetate Nickel Carbonate	15299-99-7 373-02-4 3333-67-3			1.50E+06 1.50E+06	1.50E+06 1.50E+06	2.30E+04 2.60E+03	8.70E+04	6.00E+04 6.00E+04	1.80E+04 2.50E+03 2.50E+03	
				2.60E-04 2.60E-04 2.60E-04	C C C	1.10E-02 1.10E-02 1.10E-02	C C C	1.40E-05 1.40E-05 1.40E-05	C C C	0.04 0.04 0.04		1.36E+09 1.36E+09 1.36E+09			Nickel Carbonyl Nickel Hydroxide Nickel Oxide	13463-39-3 12054-48-7 1313-99-1		1.50E+06 1.50E+06 1.50E+06	1.50E+06 1.50E+06 1.50E+06	2.60E+03 2.60E+03 2.60E+03	6.00E+04 6.00E+04 8.50E+04	2.50E+03 2.50E+03 2.50E+03			
				2.40E-04 2.60E-04 1.70E+00	I C C	1.10E-02 2.00E-02 4.80E-04	C C I	1.40E-05 9.00E-05 1.40E-05	C A C	0.04 0.04 0.04		1.36E+09 1.36E+09 1.36E+09			Nickel Refinery Dust Nickel Soluble Salts Nickel Subsulphide	NA 7440-02-0 12035-72-2	4.10E+01	1.60E+06 1.50E+06 8.00E+05	1.60E+06 1.50E+06 4.10E+01	2.60E+03 4.70E+03 2.60E+03	6.00E+04 3.80E+05 6.00E+04	2.50E+03 4.60E+03 2.50E+03			
				2.60E-04	C	1.10E-02	C	1.40E-05	C	0.04		1.36E+09			Nickelocene Nitrate Nitrate + Nitrite (as N)	1271-28-9 14797-55-8 NA		1.50E+06 1.50E+06	1.50E+06		2.60E+03 3.80E+05	6.00E+04		2.50E+03 3.80E+05	
				1.00E-01 1.00E-02 4.00E-03	I P I					1 1 1	0.1 0.1 0.1	1.36E+09 1.36E+09 1.36E+09			Nitrite Nitroaniline, 2- Nitroaniline, 4-	14797-65-0 88-74-4 100-01-6				2.70E+03	2.30E+04 2.30E+03 9.40E+02	8.70E+03 3.50E+03	2.10E+05 2.60E+07	2.30E+04 1.80E+03 7.40E+02	
2.00E-02	P			4.00E-05	I	2.00E-03	I	9.00E-03	I V	1		3.05E+03	1.36E+09	7.32E+04		Nitrobenzene Nitrocellulose Nitrofurantoin	98-95-3 9004-70-0 67-20-9	3.50E+03	1.10E+04	5.10E+02	5.10E+02	4.70E+02 7.00E+08 1.60E+04	5.10E+02 2.60E+09 6.10E+04	2.10E+03	3.80E+02 5.50E+08 1.30E+04
1.30E+00 1.70E-02	C P	3.70E-04 C		1.00E-04 P						1 1	0.1 0.1	1.36E+09 1.36E+09			Nitrofurazone Nitroglycerin Nitroguanidine	69-87-0 95-63-0 556-88-7	5.30E+01 4.10E+03	1.80E+02 1.30E+04	1.00E+06 3.10E+03	4.10E+01 3.10E+03	2.30E+01 2.30E+04	8.70E+01 8.70E+04		1.80E+01 1.80E+04	
				8.80E-06 2.70E-03 7.70E-03	P H C	5.00E-03 2.00E-02	P V I V		M	1 1 1	0.1 0.1 0.1	1.80E+04 4.86E+03 1.36E+09	1.69E+04 1.31E+04 1.36E+09		Nitromethane Nitropropane, 2- Nitroso-N-ethylurea, N-	75-52-5 78-16-9 759-73-9	5.70E-01	2.00E+00	5.40E+02 1.40E+00 1.80E+04	5.40E+02 1.40E+00 4.40E-01			2.60E+02 8.20E+02	2.60E+02 8.20E+02	
1.20E+02 5.40E+00 7.00E+00	C I I	3.40E-02 1.60E-03 2.00E-03	C							1 1 1	0.1 0.1 0.1	1.36E+09 1.36E+09 1.36E+09			Nitroso-N-methylurea, N- Nitroso-di-N-butylamine, N- Nitroso-di-N-propylamine, N-	684-93-5 924-16-3 621-64-7	1.30E-01 1.30E+01 9.90E+00	4.50E-01 3.50E+01 3.30E+01	4.10E+03 3.50E+01 1.90E+05	9.90E-02 9.40E+00 7.60E+00					
2.80E+00 1.50E+02 5.10E+01	I I I	8.00E-04 4.30E-02 1.40E-02	C C I			8.00E-06	P	4.00E-05	X	1 1 1	0.1 0.1 0.1	1.36E+09 1.36E+09 1.36E+09			Nitrosodiethanolamine, N- Nitrosodiethylamine, N- Nitrosodimethylamine, N-	1116-54-7 55-18-5 62-75-9	2.50E+01 1.00E-01 3.00E-01	8.10E+01 3.60E-01 1.10E+00	4.80E+05 3.20E+03 9.80E+03	1.90E+01 7.90E-02 2.30E-01	1.90E+00 7.00E+00	1.70E+05	1.50E+00		
4.90E-03 2.20E+01 6.70E+00	I I C	2.60E-06 6.30E-03 1.90E-03	C C C							1 1 1	0.1 0.1 0.1	1.36E+09 1.36E+09 1.36E+09			Nitrosodiphenylamine, N- Nitrosomethylethylamine, N- Nitrosomorpholine [N-]	86-30-6 10595-95-6 59-89-2	1.40E+04 3.20E+00 1.00E+01	4.60E+04 1.00E+01 3.40E+01	1.50E+08 6.10E+04 2.00E+05	1.10E+04 2.40E+00 7.90E+00					
9.40E+00 2.10E+00	C I	2.70E-03 6.10E-04	C I							1 1	0.1 0.1	1.36E+09 1.36E+09			Nitrosopiperidine [N-] Nitrosopyrrolidine, N- Nitrotoluene, m-	100-75-4 930-55-2 99-08-1	7.40E+00 3.30E+01	2.40E+01 1.10E+02	1.40E+05 6.30E+05	5.70E+00 2.50E+01			2.30E+01 8.70E+01	1.80E+01	
2.20E-01 1.60E-02	P P	9.00E-04 4.00E-03	P P							1 1	0.1 0.1	1.51E+03 1.36E+09	1.37E+05 1.36E+09		Nitrotoluene, o- Nitrotoluene, p- Nonane, n-	88-72-2 99-99-0 111-84-2	3.20E+02 4.30E+03	1.40E+04	3.20E+02 3.30E+03		2.10E+02 9.40E+02 7.00E+01	3.50E+03	2.10E+02 7.40E+02 6.50E+01	2.10E+02 7.40E+02 3.40E+01	
				4.00E-02 7.00E-04 3.00E-03	I I I					1 1 1	0.1 0.1 0.1	1.36E+09 1.36E+09 1.36E+09			Norfurazone Nustar Octabromodiphenyl Ether	27314-13-2 85509-19-9 32536-52-0					9.40E+03 1.60E+02 7.00E+02	3.50E+04 6.10E+02 2.60E+03		7.40E+03 1.30E+02 5.50E+02	
				5.00E-02 2.00E-03 5.00E-02	I I I					1 1 1	0.006 0.1 0.1	1.36E+09 1.36E+09 1.36E+09			Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) Octamethylpyrophosphoramide Oryzalin	2691-41-0 152-16-9 19044-88-3					1.20E+04 4.70E+02 1.20E+04	7.30E+05 1.70E+03 4.40E+04		1.20E+04 3.70E+02 9.20E+03	
				5.00E-03 2.50E-02 1.30E-02	I I I					1 1 1	0.1 0.1 0.1	1.36E+09 1.36E+09 1.36E+09			Oxadiazon Oxamyl Paclobutrazol	19666-30-9 23135-22-0 76738-62-0					1.20E+03 5.90E+03 3.10E+03	4.40E+03 2.20E+04 1.10E+04		9.20E+02 4.60E+03 2.40E+03	
				4.50E-03 6.00E-03 5.00E-02	I H H					1 1 1	0.1 0.1 0.1	1.36E+09 1.36E+09 1.36E+09			Paraquat Dichloride Parathion Pebulate	1910-42-5 56-38-2 1114-71-2					1.10E+03 1.40E+03 1.20E+04	3.90E+03 5.20E+03 4.40E+04		8.30E+02 1.10E+03 9.20E+03	
				4.00E-02 2.00E-03 1.00E-04	I I I					1 1 1	0.1 0.1 0.1	1.36E+09 1.36E+09 1.36E+09			Pendimethalin Pentabromodiphenyl Ether Pentabromodiphenyl ether, 2,2',4,4',5,5'-(BDE-99)	40487-42-1 32534-81-9 60348-60-9					9.40E+03 4.70E+02 2.30E+01	3.50E+04 1.70E+03 8.70E+01		7.40E+03 3.70E+02 1.80E+01	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; J = New Jersey; O = EPA Office of Water; F = See FAQ; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; \* = where: n SL < 100X c SL; \*\* = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Child Hazard Index (HI) = 3			
SFO (mg/kg-day) <sup>-1</sup>	k e y	IUR (ug/m <sup>3</sup> ) <sup>-1</sup>	k e y	RfD <sub>d</sub> (mg/kg-day)	k e y	RfC <sub>i</sub> (mg/m <sup>3</sup> )	k e y	muta- gen	GI/ABS	ABS	C <sub>sat</sub> (mg/kg)	PEF (m <sup>3</sup> /kg)	VF (m <sup>3</sup> /kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-4 (mg/kg)	Dermal SL TR=1.0E-4 (mg/kg)	Inhalation SL TR=1.0E-4 (mg/kg)	Carcinogenic SL TR=1.0E-4 (mg/kg)	Ingestion SL Child HQ=3 (mg/kg)	Dermal SL Child HQ=3 (mg/kg)	Inhalation SL Child HQ=3 (mg/kg)	Noncarcinogenic SL Child HI=3 (mg/kg)
				8.00E-04	I				1	0.1		1.36E+09		Pentachlorobenzene	608-93-5					1.90E+02	7.00E+02		1.50E+02
9.00E-02	P								1	0.1		1.36E+09		Pentachloroethane	76-01-7	7.70E+02	2.50E+03		5.90E+02	7.00E+02	2.60E+03		5.50E+02
2.60E-01	H			3.00E-03	I				1	0.1		1.36E+09		Pentachloronitrobenzene	82-68-8	2.70E+02	8.80E+02		2.00E+02				
4.00E-01	I	5.10E-06	C	5.00E-03	I				1	0.25		1.36E+09		Pentachlorophenol	87-86-5	1.70E+02	2.30E+02	7.50E+07	9.90E+01	1.20E+03	1.70E+03		7.00E+02
4.00E-03	X			2.00E-03	P				1	0.1		1.36E+09		Pentaerythritol tetranitrate (PETN)	78-11-5	1.70E+04	5.70E+04		1.30E+04	4.70E+02	1.70E+03		3.70E+02
						1.00E+00	P	V	1		3.88E+02	1.36E+09	7.79E+02	Pentane, n-	109-66-0							2.40E+03	2.40E+03
				7.00E-04	I				1			1.36E+09		Perchlorates						1.60E+02			1.60E+02
				7.00E-04	I				1			1.36E+09		~Ammonium Perchlorate	7790-98-9					1.60E+02			1.60E+02
														~Lithium Perchlorate	7791-03-9								
				7.00E-04	I				1			1.36E+09		~Perchlorate and Perchlorate Salts	14797-73-0					1.60E+02			1.60E+02
				7.00E-04	I				1			1.36E+09		~Potassium Perchlorate	7778-74-7					1.60E+02			1.60E+02
				7.00E-04	I				1			1.36E+09		~Sodium Perchlorate	7601-89-0					1.60E+02			1.60E+02
				2.00E-02	P				1	0.1		1.36E+09		Perfluorobutane Sulfonate	375-73-5					4.70E+03	1.70E+04		3.70E+03
				5.00E-02	I				1	0.1		1.36E+09		Permethrin	52645-53-1					1.20E+04	4.40E+04		9.20E+03
2.20E-03	C	6.30E-07	C						1	0.1		1.36E+09		Phenacetin	62-44-2	3.20E+04	1.00E+05	6.10E+08	2.40E+04				
				2.50E-01	I				1	0.1		1.36E+09		Phenmedipham	13684-63-4					5.90E+04	2.20E+05		4.60E+04
				3.00E-01	I	2.00E-01	C		1	0.1		1.36E+09		Phenol	108-95-2					7.00E+04	2.60E+05	8.50E+08	5.50E+04
				5.00E-04	X				1	0.1		1.36E+09		Phenothiazine	92-84-2					1.20E+02	4.40E+02		9.20E+01
				6.00E-03	I				1	0.1		1.36E+09		Phenylenediamine, m-	108-45-2					1.40E+03	5.20E+03		1.10E+03
4.70E-02	H								1	0.1		1.36E+09		Phenylenediamine, o-	95-54-5	1.50E+03	4.80E+03		1.10E+03				
				1.90E-01	H				1	0.1		1.36E+09		Phenylenediamine, p-	106-50-3					4.50E+04	1.70E+05		3.50E+04
1.90E-03	H								1	0.1		1.36E+09		Phenylphenol, 2-	90-43-7	3.60E+04	1.20E+05		2.70E+04				
				2.00E-04	H				1	0.1		1.36E+09		Phorate	298-02-2					4.70E+01	1.70E+02		3.70E+01
						3.00E-04	I	V	1		1.61E+03	1.36E+09	9.81E+02	Phosgene	75-44-5							9.20E-01	9.20E-01
				2.00E-02	I				1	0.1		1.36E+09		Phosmet	732-11-6					4.70E+03	1.70E+04		3.70E+03
				4.90E+01	P				1			1.36E+09		Phosphates, Inorganic									
														~Aluminum metaphosphate	13776-88-0					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Ammonium polyphosphate	68333-79-9					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Calcium pyrophosphate	7790-76-3					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Diammonium phosphate	7783-28-0					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Dicalcium phosphate	7757-93-9					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Dimagnesium phosphate	7782-75-4					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Dipotassium phosphate	7758-11-4					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Disodium phosphate	7558-79-4					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Monoaluminum phosphate	13530-50-2					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Monoammonium phosphate	7722-76-1					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Monocalcium phosphate	7758-23-8					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Monomagnesium phosphate	7757-86-0					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Monopotassium phosphate	7778-77-0					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Monosodium phosphate	7758-80-7					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Polyphosphoric acid	8017-16-1					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Potassium tripolyphosphate	13845-36-8					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Sodium acid pyrophosphate	7758-16-9					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Sodium aluminum phosphate (acidic)	7785-88-8					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Sodium aluminum phosphate (anhydrous)	10279-59-1					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Sodium aluminum phosphate (tetrahydrate)	10305-76-7					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Sodium hexametaphosphate	10124-56-8					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Sodium polyphosphate	68915-31-1					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Sodium trimetaphosphate	7785-84-4					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Sodium tripolyphosphate	7758-29-4					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Tetrapotassium phosphate	7320-34-5					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Tetrasodium pyrophosphate	7722-00-5					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Trialuminum sodium tetra decahydrogenoctaorthophosphate (dihydrate)	15136-87-5					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Tricalcium phosphate	7758-87-4					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Trimagnesium phosphate	7757-87-1					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Tripotassium phosphate	7778-53-2					1.10E+07			1.10E+07
				4.90E+01	P				1			1.36E+09		~Trisodium phosphate	7601-54-9					1.10E+07			1.10E+07
				3.00E-04	I	3.00E-04	I		1			1.36E+09		Phosphine	7803-51-2					7.00E+01		1.30E+06	7.00E+01
				4.90E+01	P	1.00E-02	I		1			1.36E+09		Phosphoric Acid	7664-38-2					1.10E+07		4.30E+07	9.00E+06
				2.00E-05	I				1			1.36E+09		Phosphorus, White	7723-14-0								

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; J = New Jersey; O = EPA Office of Water; F = See FAQ; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; \* = where: n SL < 100X c SL; \*\* = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information													Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Child Hazard Index (HI) = 3					
SFO (mg/kg-day) <sup>-1</sup>	k e y	IUR (ug/m <sup>3</sup> ) <sup>-1</sup>	k e y	RfD <sub>o</sub> (mg/kg-day)	k e y	RfC <sub>i</sub> (mg/m <sup>3</sup> )	k e y	muta- gen	GIABS	ABS	C <sub>sat</sub> (mg/kg)	PEF (m <sup>3</sup> /kg)	VF (m <sup>3</sup> /kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-4 (mg/kg)	Dermal SL TR=1.0E-4 (mg/kg)	Inhalation SL TR=1.0E-4 (mg/kg)	Carcinogenic SL TR=1.0E-4 (mg/kg)	Ingestion SL Child HQ=3 (mg/kg)	Dermal SL Child HQ=3 (mg/kg)	Inhalation SL Child HQ=3 (mg/kg)	Noncarcinogenic SL Child HI=3 (mg/kg)	
2.00E+00	S	5.70E-04	S				V			1	0.14	7.57E+02	1.36E+09	8.51E+04	-Aroclor 1221	11104-28-2	3.50E+01	8.10E+01	4.20E+01	1.50E+01				
2.00E+00	S	5.70E-04	S				V			1	0.14	7.32E+01	1.36E+09	8.51E+04	-Aroclor 1232	11141-16-5	3.50E+01	8.10E+01	4.20E+01	1.50E+01				
2.00E+00	S	5.70E-04	S							1	0.14		1.36E+09		-Aroclor 1242	53469-21-9	3.50E+01	8.10E+01	6.70E+05	2.40E+01				
2.00E+00	S	5.70E-04	S							1	0.14		1.36E+09		-Aroclor 1248	12672-29-6	3.50E+01	8.10E+01	6.70E+05	2.40E+01				
2.00E+00	S	5.70E-04	S	2.00E-05	I					1	0.14		1.36E+09		-Aroclor 1254	11097-69-1	3.50E+01	8.10E+01	6.70E+05	2.40E+01	4.70E+00	1.20E+01		3.40E+00
2.00E+00	S	5.70E-04	S							1	0.14		1.36E+09		-Aroclor 1260	11096-82-5	3.50E+01	8.10E+01	6.70E+05	2.40E+01				
3.90E+00	E	1.10E-03	E	6.00E-04	X					1	0.1		1.36E+09		-Aroclor 5460	11126-42-4	1.80E+01	4.20E+01	3.30E+05	1.20E+01	1.40E+02	5.20E+02		1.10E+02
3.90E+00	E	1.10E-03	E	2.30E-05	E	1.30E-03	E			1	0.14		1.36E+09		-Heptachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 189)	39635-31-9	1.80E+01	4.20E+01	3.30E+05	1.20E+01	5.50E+00	1.50E+01	5.70E+06	4.00E+00
3.90E+00	E	1.10E-03	E	2.30E-05	E	1.30E-03	E			1	0.14		1.36E+09		-Hexachlorobiphenyl, 2,3',4,4',5,5'- (PCB 167)	52663-72-6	1.80E+01	4.20E+01	3.30E+05	1.20E+01	5.50E+00	1.50E+01	5.70E+06	4.00E+00
3.90E+00	E	1.10E-03	E	2.30E-05	E	1.30E-03	E			1	0.14		1.36E+09		-Hexachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 157)	69782-90-7	1.80E+01	4.20E+01	3.30E+05	1.20E+01	5.50E+00	1.50E+01	5.70E+06	4.00E+00
3.90E+00	E	1.10E-03	E	2.30E-05	E	1.30E-03	E			1	0.14		1.36E+09		-Hexachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 156)	38380-08-4	1.80E+01	4.20E+01	3.30E+05	1.20E+01	5.50E+00	1.50E+01	5.70E+06	4.00E+00
3.90E+03	E	1.10E+00	E	2.30E-08	E	1.30E-06	E			1	0.14		1.36E+09		-Hexachlorobiphenyl, 3,3',4,4',5,5'- (PCB 169)	32774-16-6	1.80E-02	4.20E-02	3.30E+02	1.20E-02	5.50E-03	1.50E-02	5.70E+03	4.00E-03
3.90E+00	E	1.10E-03	E	2.30E-05	E	1.30E-03	E			1	0.14		1.36E+09		-Pentachlorobiphenyl, 2',3,4,4',5- (PCB 123)	65510-44-3	1.80E+01	4.20E+01	3.30E+05	1.20E+01	5.50E+00	1.50E+01	5.70E+06	4.00E+00
3.90E+00	E	1.10E-03	E	2.30E-05	E	1.30E-03	E			1	0.14		1.36E+09		-Pentachlorobiphenyl, 2,3,4,4',5- (PCB 118)	31508-00-6	1.80E+01	4.20E+01	3.30E+05	1.20E+01	5.50E+00	1.50E+01	5.70E+06	4.00E+00
3.90E+00	E	1.10E-03	E	2.30E-05	E	1.30E-03	E			1	0.14		1.36E+09		-Pentachlorobiphenyl, 2,3,3',4,4',5- (PCB 105)	32598-14-4	1.80E+01	4.20E+01	3.30E+05	1.20E+01	5.50E+00	1.50E+01	5.70E+06	4.00E+00
3.90E+00	E	1.10E-03	E	2.30E-05	E	1.30E-03	E			1	0.14		1.36E+09		-Pentachlorobiphenyl, 2,3,4,4',5- (PCB 114)	74472-37-0	1.80E+01	4.20E+01	3.30E+05	1.20E+01	5.50E+00	1.50E+01	5.70E+06	4.00E+00
1.30E+04	E	3.80E+00	E	7.00E-09	E	4.00E-07	E			1	0.14		1.36E+09		-Pentachlorobiphenyl, 3,3',4,4',5- (PCB 126)	57465-28-8	5.30E-03	1.30E-02	1.00E+02	3.70E-03	1.60E-03	4.40E-03	1.70E+03	1.20E-03
2.00E+00	I	5.70E-04	I							1	0.14		1.36E+09		-Polychlorinated Biphenyls (high risk)	1336-36-3	3.50E+01	8.10E+01	6.70E+05	2.40E+01				
4.00E-01	I	1.00E-04	I							1	0.14		1.36E+09		-Polychlorinated Biphenyls (low risk)	1336-36-3								
7.00E-02	I	2.00E-05	I							1	0.14		1.36E+09		-Polychlorinated Biphenyls (lowest risk)	1336-36-3								
1.30E+01	E	3.80E-03	E	7.00E-06	E	4.00E-04	E			1	0.14		1.36E+09		-Tetrachlorobiphenyl, 3,3',4,4'- (PCB 77)	32598-13-3	5.30E+00	1.30E+01	1.00E+05	3.70E+00	1.60E+00	4.40E+00	1.70E+06	1.20E+00
3.90E+01	E	1.10E-02	E	2.30E-06	E	1.30E-04	E			1	0.14		1.36E+09		-Tetrachlorobiphenyl, 3,4,4',5- (PCB 81)	70362-50-4	1.80E+00	4.20E+00	3.30E+04	1.20E+00	5.50E-01	1.50E+00	5.70E+05	4.00E-01
				6.00E-04	I					1	0.1		1.36E+09		Polymeric Methylene Diphenyl Diisocyanate (PMDI)	9016-87-9							2.60E+06	2.60E+06
														<b>Polynuclear Aromatic Hydrocarbons (PAHs)</b>										
				6.00E-02	I		V			1	0.13		1.36E+09	1.41E+05	-Acenaphthene	83-32-9					1.40E+04	4.00E+04		1.00E+04
7.30E-01	E	1.10E-04	C	3.00E-01	I		V			1	0.13		1.36E+09	5.23E+05	-Anthracene	120-12-7					7.00E+04	2.00E+05		5.20E+04
								M		1	0.13		1.36E+09		-Dibenz[a]anthracene	56-55-3	2.10E-01	5.70E+01	1.30E+06	1.50E+01				
1.20E+00	C	1.10E-04	C							1	0.13		1.36E+09		-Benzo[j]fluoranthene	205-82-3	5.80E+01	1.50E+02	3.50E+06	4.10E+01				
7.30E+00	I	1.10E-03	C					M		1	0.13		1.36E+09		-Benzo[a]pyrene	50-32-8	2.10E+00	5.70E+00	1.30E+05	1.50E+00				
7.30E-01	E	1.10E-04	C					M		1	0.13		1.36E+09		-Benzo[b]fluoranthene	205-99-2	2.10E+01	5.70E+01	1.30E+06	1.50E+01				
7.30E-02	E	1.10E-04	C					M		1	0.13		1.36E+09		-Benzo[k]fluoranthene	207-08-9	2.10E+02	5.70E+02	1.30E+06	1.50E+02				
7.30E-03	E	1.10E-05	C	8.00E-02	I		V			1	0.13		1.36E+09	7.99E+04	-Chloronaphthalene, Beta-	91-58-7					1.90E+04			1.90E+04
								M		1	0.13		1.36E+09		-Chrysene	218-01-9	2.10E+03	5.70E+03	1.30E+07	1.50E+03				
7.30E+00	E	1.20E-03	C					M		1	0.13		1.36E+09		-Dibenz[a,h]anthracene	53-70-3	2.10E+00	5.70E+00	1.10E+05	1.50E+00				
1.20E+01	C	1.10E-03	C					M		1	0.13		1.36E+09		-Dibenzo[a,e]pyrene	192-65-4	5.80E+00	1.50E+01	3.50E+05	4.10E+00				
2.50E+02	C	7.10E-02	C					M		1	0.13		1.36E+09		-Dimethylbenz[a]anthracene, 7,12-	57-97-6	6.10E-02	1.70E-01	1.90E+03	4.50E-02				
				4.00E-02	I					1	0.13		1.36E+09		-Fluoranthene	206-44-0					9.40E+03	2.70E+04		7.00E+03
				4.00E-02	I		V			1	0.13		1.36E+09	2.81E+05	-Fluorene	86-73-7					9.40E+03	2.70E+04		7.00E+03
7.30E-01	E	1.10E-04	C					M		1	0.13		1.36E+09		-Indeno[1,2,3-cd]pyrene	193-39-5	2.10E+01	5.70E+01	1.30E+06	1.50E+01				
2.90E-02	P			7.00E-02	A		V			1	0.13		1.36E+09	5.86E+04	-Methylnaphthalene, 1-	90-12-0	2.40E+03	6.00E+03		1.70E+03	1.60E+04	4.70E+04		1.20E+04
				4.00E-03	I		V			1	0.13		1.36E+09	5.80E+04	-Methylnaphthalene, 2-	91-57-6					9.40E+02	2.70E+03		7.00E+02
				3.40E-05	C	2.00E-02	I	3.00E-03	I	V	1	0.13	1.36E+09	4.63E+04	-Naphthalene	91-20-3			3.80E+02	3.80E+02	4.70E+03	1.30E+04	4.30E+02	3.90E+02
1.20E+00	C	1.10E-04	C							1	0.13		1.36E+09		-Nitropyrene, 4-	57835-92-4	5.80E+01	1.50E+02	3.50E+06	4.10E+01				
				3.00E-02	I		V			1	0.13		1.36E+09	2.38E+06	-Pyrene	129-00-0					7.00E+03	2.00E+04		5.20E+03
				2.00E-02	P					1	0.1		1.36E+09		Potassium Perfluorobutane Sulfonate	29420-49-3					4.70E+03	1.70E+04		3.70E+03
1.50E-01	I			9.00E-03	I					1	0.1		1.36E+09		Prochloraz	67747-09								



Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; J = New Jersey; O = EPA Office of Water; F = See FAQ; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; \* = where: n SL < 100X c SL; \*\* = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Child Hazard Index (HI) = 3				
SFO (mg/kg-day) <sup>-1</sup>	k <sub>e</sub> (y)	IUR (ug/m <sup>3</sup> ) <sup>-1</sup>	k <sub>e</sub> (y)	RfD <sub>c</sub> (mg/kg-day)	k <sub>e</sub> (y)	RfC <sub>c</sub> (mg/m <sup>3</sup> )	k <sub>e</sub> (y)	v <sub>c</sub> (y)	muta- gen	GIABS	ABS	C <sub>sat</sub> (mg/kg)	PEF (m <sup>3</sup> /kg)	VF (m <sup>3</sup> /kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-4 (mg/kg)	Dermal SL TR=1.0E-4 (mg/kg)	Inhalation SL TR=1.0E-4 (mg/kg)	Carcinogenic SL TR=1.0E-4 (mg/kg)	Ingestion SL Child HQ=3 (mg/kg)	Dermal SL Child HQ=3 (mg/kg)	Inhalation SL Child HQ=3 (mg/kg)	Noncarcinogenic SL Child HI=3 (mg/kg)
				5.00E-03	I					1			1.36E+09		Selenious Acid	7783-00-8					1.20E+03			1.20E+03
				5.00E-03	I	2.00E-02	C			1			1.36E+09		Selenium	7782-49-2					1.20E+03		8.50E+07	1.20E+03
				5.00E-03	C	2.00E-02	C			1			1.36E+09		Selenium Sulfide	7446-34-6					1.20E+03		8.50E+07	1.20E+03
				9.00E-02	I					1	0.1		1.36E+09		Sethoxydim	74051-80-2					2.10E+04	7.90E+04		1.70E+04
						3.00E-03	C			1			1.36E+09		Silica (crystalline, respirable)	7631-86-9							1.30E+07	1.30E+07
				5.00E-03	I					0.04			1.36E+09		Silver	7440-22-4					1.20E+03			1.20E+03
1.20E-01	H			5.00E-03	I					1	0.1		1.36E+09		Simazine	122-34-9	5.80E+02	1.90E+03		4.40E+02	1.20E+03	4.40E+03		9.20E+02
				1.30E-02	I					1	0.1		1.36E+09		Sodium Acifluorfen	62476-59-9					3.10E+03	1.10E+04		2.40E+03
				4.00E-03	I					1			1.36E+09		Sodium Azide	26628-22-8					9.40E+02			9.40E+02
5.00E-01	C	1.50E-01	C	2.00E-02	C	2.00E-04	C		M	0.025			1.36E+09		Sodium Dichromate	10588-01-9	3.10E+01		9.20E+02	3.00E+01	4.70E+03		8.50E+05	4.70E+03
2.70E-01	H			3.00E-02	I					1	0.1		1.36E+09		Sodium Diethyldithiocarbamate	148-18-5	2.60E+02	8.40E+02	2.00E+02		7.00E+03	2.60E+04		5.50E+03
				5.00E-02	A	1.30E-02	C			1			1.36E+09		Sodium Fluoride	7681-49-4					1.20E+04		5.50E+07	1.20E+04
				2.00E-05	I					1	0.1		1.36E+09		Sodium Fluoroacetate	62-74-8					4.70E+00	1.70E+01		3.70E+00
				1.00E-03	H					1			1.36E+09		Sodium Metavanadate	13718-26-8					2.30E+02			2.30E+02
2.40E-02	H			3.00E-02	I					1	0.1		1.36E+09		Stirofos (Tetrachlorovinphos)	961-11-5	2.90E+03	9.50E+03		2.20E+03	7.00E+03	2.60E+04		5.50E+03
5.00E-01	C	1.50E-01	C	2.00E-02	C	2.00E-04	C		M	0.025			1.36E+09		Strontium Chromate	7789-06-2	3.10E+01		9.20E+02	3.00E+01	4.70E+03		8.50E+05	4.70E+03
				6.00E-01	I					1			1.36E+09		Strontium, Stable	7440-24-6					1.40E+05			1.40E+05
				3.00E-04	I					1	0.1		1.36E+09		Strychnine	57-24-9					7.00E+01	2.60E+02		5.50E+01
				2.00E-01	I	1.00E+00	I	V		1		8.67E+02	1.36E+09	9.35E+03	Styrene	100-42-5					4.70E+04		2.90E+04	1.80E+04
				3.00E-03	P					1	0.1		1.36E+09		Styrene-Acrylonitrile (SAN) Trimer	NA					7.00E+02	2.60E+03		5.50E+02
				1.00E-03	P	2.00E-03	X			1	0.1		1.36E+09		Sulfolane	126-33-0					2.30E+02	8.70E+02		8.50E+06
				8.00E-04	P					1	0.1		1.36E+09		Sulfonylbis(4-chlorobenzene), 1,1'-	80-07-9					1.90E+02	7.00E+02		1.50E+02
						1.00E-03	C			1			1.36E+09		Sulfur Trioxide	7446-11-9							4.30E+06	4.30E+06
						1.00E-03	C			1			1.36E+09		Sulfuric Acid	7664-93-9							4.30E+06	4.30E+06
				2.50E-02	I					1	0.1		1.36E+09		Systhane	88671-89-0					5.90E+03	2.20E+04		4.60E+03
				3.00E-02	H					1	0.1		1.36E+09		TCMTB	21564-17-0					7.00E+03	2.60E+04		5.50E+03
				7.00E-02	I					1	0.1		1.36E+09		Tebuthiuron	34014-18-1					1.60E+04	6.10E+04		1.30E+04
				2.00E-02	H					1	0.1		1.36E+09		Temephos	3383-96-8					4.70E+03	1.70E+04		3.70E+03
				1.30E-02	I					1	0.1		1.36E+09		Terbacol	5902-51-2					3.10E+03	1.10E+04		2.40E+03
				2.50E-05	H					1	0.1		1.36E+09		Terbufos	13071-79-9					5.90E+00	2.20E+01		4.60E+00
				1.00E-03	I					1	0.1		1.36E+09		Terbutryn	886-50-0					2.30E+02	8.70E+02		1.80E+02
				1.00E-04	I					1	0.1		1.36E+09		Tetrabromodiphenyl ether, 2,2',4,4'-(BDE-47)	5436-43-1	2.70E+03		2.20E+02	2.00E+02	7.00E+03			7.00E+03
				3.00E-04	I					1	0.1		1.36E+09		Tetrachlorobenzene, 1,2,4,6-	95-94-3	3.50E+02		7.30E+01	6.00E+01	4.70E+03			4.70E+03
2.60E-02	I	7.40E-06	I	3.00E-02	I		V			1		6.80E+02	1.36E+09	5.68E+03	Tetrachloroethane, 1,1,1,2-	630-20-6	2.70E+03		2.20E+02	2.00E+02	7.00E+03			7.00E+03
2.00E-01	I	5.80E-05	C	2.00E-02	I		V			1		1.90E+03	1.36E+09	1.51E+04	Tetrachloroethane, 1,1,2,2-	79-34-5	3.50E+02		7.30E+01	6.00E+01	4.70E+03			4.70E+03
2.10E-03	I	2.60E-07	I	6.00E-03	I	4.00E-02	I	V		1		1.66E+02	1.36E+09	2.35E+03	Tetrachloroethylene	127-18-4	3.30E+04		2.50E+03	2.40E+03	1.40E+03		2.90E+02	2.40E+02
				3.00E-02	I					1	0.1		1.36E+09		Tetrachlorophenol, 2,3,4,6-	58-90-2					7.00E+03	2.60E+04		5.50E+03
2.00E+01	H			5.00E-04	I					1	0.1		1.36E+09		Tetrachlorotoluene, p- alpha, alpha, alpha-	5216-25-1	3.50E+00	1.10E+01		2.70E+00	1.20E+02	4.40E+02		9.20E+01
						8.00E+01	I	V		1		1.09E+03	1.36E+09	1.22E+03	Tetraethyl Dithiopyrophosphate	3689-24-5					1.20E+02			
				2.00E-03	P					1	0.1		1.36E+09		Tetrafluoroethane, 1,1,1,2-	811-97-2							3.10E+05	3.10E+05
				7.00E-06	X					1			1.36E+09		Tetryl (Trinitrophenylmethyl nitramine)	479-45-8					4.70E+02	1.70E+03		3.70E+02
				1.00E-05	X					1			1.36E+09		Thallium (I) Nitrate	10102-45-1					1.60E+00			1.60E+00
				6.00E-06	X					1			1.36E+09		Thallium (Soluble Salts)	7440-28-0					2.30E+00			2.30E+00
				2.00E-05	X					1			1.36E+09		Thallium Acetate	563-68-8					1.40E+00			1.40E+00
										1			1.36E+09		Thallium Carbonate	6533-73-9					4.70E+00			4.70E+00
				6.00E-06	X					1			1.36E+09		Thallium Chloride	7791-12-0					1.40E+00			1.40E+00
				2.00E-05	X					1			1.36E+09		Thallium Sulfate	7446-18-6					4.70E+00			4.70E+00
				1.00E-02	I					1	0.1		1.36E+09		Thiobencarb	28249-77-6					2.30E+03	8.70E+03		1.80E+03
				7.00E-02	X					1	0.008		1.36E+09		Thiodiglycol	111-48-8					1.60E+04	8.10E+05		1.60E+04
				3.00E-04	H					1	0.1		1.36E+09		Thiofanox	39196-18-4					7.00E+01	2.60E+02		5.50E+01
				8.00E-02	I					1	0.1		1.36E+09		Thiophanate, Methyl	23564-05-8					1.90E+04	7.00E+04		1.50E+04
				5.00E-03	I					1	0.1		1.36E+09		Thiram	137-26-8					1.20E+03	4.40E+03		9.20E+02
				6.00E-01	H					1			1.36E+09		Tin	7440-31-5					1.40E+05			1.40E+05
						1.00E-04	A			1			1.36E+09		Titanium Tetrachloride	7550-45-0							4.30E+05	4.30E+0

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; J = New Jersey; O = EPA Office of Water; F = See FAQ; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; R = RBA applied (See User Guide for Arsenic notice); c = cancer; \* = where: n SL < 100X c SL; \*\* = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information														Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Child Hazard Index (HI) = 3					
SFO (mg/kg-day) <sup>-1</sup>	k e y	IUR (ug/m <sup>3</sup> ) <sup>-1</sup>	k e y	RfD <sub>c</sub> (mg/kg-day)	k e y	RfC <sub>c</sub> (mg/m <sup>3</sup> )	k e y	v o l u m e	muta- gen	GI/ABS	ABS	C <sub>sat</sub> (mg/kg)	PEF (m <sup>3</sup> /kg)	VF (m <sup>3</sup> /kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-4 (mg/kg)	Dermal SL TR=1.0E-4 (mg/kg)	Inhalation SL TR=1.0E-4 (mg/kg)	Carcinogenic SL TR=1.0E-4 (mg/kg)	Ingestion SL Child HQ=3 (mg/kg)	Dermal SL Child HQ=3 (mg/kg)	Inhalation SL Child HQ=3 (mg/kg)	Noncarcinogenic SL Child HI=3 (mg/kg)	
4.60E-02	I	4.10E-06	I	5.00E-04	I	2.00E-03	I	V	M	1		6.92E+02	1.36E+09	2.21E+03	Trichloroethylene	79-01-6	8.80E+02		1.10E+02	9.40E+01	1.20E+02			1.40E+01	1.20E+01
				3.00E-01	I	7.00E-01	H	V		1		1.23E+03	1.36E+09	1.04E+03	Trichlorofluoromethane	75-69-4					7.00E+04		2.30E+03		2.20E+03
				1.00E-01	I					1	0.1		1.36E+09		Trichlorophenol, 2,4,5-	95-95-4					2.30E+04	8.70E+04			1.80E+04
1.10E-02	I	3.10E-06	I	1.00E-03	P					1	0.1		1.36E+09		Trichlorophenol, 2,4,6-	88-06-2	6.30E+03	2.10E+04	1.20E+08	4.80E+03	2.30E+02	8.70E+02			1.80E+02
				1.00E-02	I					1	0.1		1.36E+09		Trichlorophenoxyacetic Acid, 2,4,5-	93-76-5					2.30E+03	8.70E+03			1.80E+03
				8.00E-03	I					1	0.1		1.36E+09		Trichlorophenoxypropionic acid, -2,4,5	93-72-1					1.90E+03	7.00E+03			1.50E+03
3.00E+01	I			5.00E-03	I			V		1		1.28E+03	1.36E+09	1.50E+04	Trichloropropane, 1,1,2-	598-77-6	5.10E-01			5.10E-01	1.20E+03				1.20E+03
				4.00E-03	I	3.00E-04	I	V	M	1		1.40E+03	1.36E+09	1.57E+04	Trichloropropane, 1,2,3-	96-18-4					9.40E+02		1.50E+01		1.50E+01
				3.00E-03	X	3.00E-04	P	V		1		4.51E+02	1.36E+09	2.34E+03	Trichloropropane, 1,2,3-	96-19-5					7.00E+02		2.20E+00		2.20E+00
				2.00E-02	A					1	0.1		1.36E+09		Tricresyl Phosphate (TCP)	1330-78-5					4.70E+03	1.70E+04			3.70E+03
				3.00E-03	I					1	0.1		1.36E+09		Tridiphenylmethane	58138-08-2					7.00E+02	2.60E+03			5.50E+02
						7.00E-03	I	V		1		2.79E+04	1.36E+09	1.58E+04	Tridiphenylmethane	121-44-8							3.50E+02		3.50E+02
7.70E-03	I			2.00E+00	P					1	0.1		1.36E+09		Tridiphenyl Glycol	112-27-6					4.70E+05	1.70E+06			3.70E+05
2.00E-02	P			7.50E-03	I					1	0.1		1.36E+09		Trifluralin	1582-09-8	9.00E+03	3.00E+04		6.90E+03	1.80E+03	6.50E+03			1.40E+03
				1.00E-02	P					1	0.1		1.36E+09		Trimethyl Phosphate	512-56-1	3.50E+03	1.10E+04		2.70E+03	2.30E+03	8.70E+03			1.80E+03
						5.00E-03	P	V		1		2.93E+02	1.36E+09	9.44E+03	Trimethylbenzene, 1,2,3-	526-73-8							1.50E+02		1.50E+02
						7.00E-03	P	V		1		2.19E+02	1.36E+09	7.91E+03	Trimethylbenzene, 1,2,4-	95-63-6							1.70E+02		1.70E+02
				1.00E-02	X					1		1.82E+02	1.36E+09	6.61E+03	Trimethylbenzene, 1,3,5-	108-67-8					2.30E+03		1.70E+02		2.30E+03
3.00E-02	I			3.00E-02	I					1	0.019		1.36E+09		Trinitrobenzene, 1,3,5-	99-35-4				2.10E+03	7.00E+03	1.40E+05			6.70E+03
				5.00E-04	I					1	0.032		1.36E+09		Trinitrotoluene, 2,4,6-	118-96-7	2.30E+03	2.40E+04			1.20E+02	1.40E+03			1.10E+02
				2.00E-02	P					1	0.1		1.36E+09		Triphenylphosphine Oxide	791-28-6					4.70E+03	1.70E+04			3.70E+03
				2.00E-02	A					1	0.1		1.36E+09		Tris(1,3-Dichloro-2-propyl) Phosphate	13674-87-8					4.70E+03	1.70E+04			3.70E+03
2.00E-02	P			1.00E-02	X					1	0.1		1.36E+09		Tris(1-chloro-2-propyl)phosphate	13674-84-5					2.30E+03	8.70E+03			1.80E+03
				7.00E-03	P					1	0.1		1.36E+09		Tris(2-chloroethyl)phosphate	115-96-8	3.50E+03	1.10E+04		2.70E+03	1.60E+03	6.10E+03			1.30E+03
3.20E-03	P			1.00E-01	P					1	0.1		1.36E+09		Tris(2-ethylhexyl)phosphate	78-42-2	2.20E+04	7.10E+04		1.70E+04	2.30E+04	8.70E+04			1.80E+04
				3.00E-03	I	4.00E-05	A			1			1.36E+09		Uranium (Soluble Salts)	NA	1.50E+01	5.40E+01	4.80E+05	1.20E+01	7.00E+02		1.70E+05		7.00E+02
1.00E+00	C	2.90E-04	C						M	1	0.1		1.36E+09		Urethane	51-79-6									
		8.30E-03	P	9.00E-03	I	7.00E-06	P			0.026			1.36E+09		Vanadium Pentoxide	1314-62-1			4.60E+04	4.60E+04	2.10E+03		3.00E+04		2.00E+03
				5.00E-03	S	1.00E-04	A			0.026			1.36E+09		Vanadium and Compounds	7440-62-2					1.20E+03		4.30E+05		1.20E+03
				1.00E-03	I					1	0.1		1.36E+09		Vernolate	1929-77-7					2.30E+02	8.70E+02			1.80E+02
				2.50E-02	I					1	0.1		1.36E+09		Vinclozolin	50471-44-8					5.90E+03	2.20E+04			4.60E+03
				1.00E+00	H	2.00E-01	I	V		1		2.75E+03	1.36E+09	4.40E+03	Vinyl Acetate	108-05-4					2.30E+05		2.80E+03		2.70E+03
		3.20E-05	H			3.00E-03	I	V		1		3.37E+03	1.36E+09	1.37E+03	Vinyl Bromide	593-60-2			1.20E+01	1.20E+01			1.30E+01		1.30E+01
7.20E-01	I	4.40E-06	I	3.00E-03	I	1.00E-01	I	V	M	1		3.92E+03	1.36E+09	9.56E+02	Vinyl Chloride	75-01-4	9.40E+00		1.60E+01	5.90E+00	7.00E+02		3.00E+02		2.10E+02
				3.00E-04	I					1	0.1		1.36E+09		Warfarin	81-81-2					7.00E+01	2.60E+02			5.50E+01
				2.00E-01	S	1.00E-01	S	V		1		3.90E+02	1.36E+09	5.58E+03	Xylene, P-	106-42-3					4.70E+04		1.70E+03		1.70E+03
				2.00E-01	S	1.00E-01	S	V		1		3.88E+02	1.36E+09	5.47E+03	Xylene, m-	108-38-3					4.70E+04		1.70E+03		1.70E+03
				2.00E-01	S	1.00E-01	S	V		1		4.34E+02	1.36E+09	6.46E+03	Xylene, o-	95-47-6					4.70E+04		2.00E+03		1.90E+03
				2.00E-01	I	1.00E-01	I	V		1		2.58E+02	1.36E+09	5.82E+03	Xylenes	1330-20-7					4.70E+04		1.80E+03		1.80E+03
				3.00E-04	I					1			1.36E+09		Zinc Phosphide	1314-84-7					7.00E+01				7.00E+01
				3.00E-01	I					1			1.36E+09		Zinc and Compounds	7440-66-6					7.00E+04				7.00E+04
				5.00E-02	I					1	0.1		1.36E+09		Zineb	12122-67-7					1.20E+04	4.40E+04			9.20E+03
				8.00E-05	X					1			1.36E+09		Zirconium	7440-67-7					1.90E+01				1.90E+01



**Weston Solutions, Inc.**  
Suite 201  
1090 King Georges Post Road  
Edison, New Jersey 08837-3703  
732-585-4400 • Fax: 732-225-7037  
www.westonsolutions.com

***The Trusted Integrator for Sustainable Solutions***

REMOVAL SUPPORT TEAM 3  
EPA CONTRACT EP-S2-14-01

July 24, 2015

Mr. David Rosoff, On-Scene Coordinator  
U.S. Environmental Protection Agency, Region II  
Removal Action Branch  
2890 Woodbridge Avenue  
Edison, NJ 08837

**EPA CONTRACT No.: EP-S2-14-01**

**TDD No.: TO-0006-0056**

**DOCUMENT CONTROL No.: RST3-02-D-0014**

**SUBJECT: SITE-SPECIFIC HEALTH & SAFETY PLAN – LAKE ERIE SMELTING  
SITE - BUFFALO, ERIE COUNTY, NEW YORK**

Dear Mr. Rosoff,

Enclosed please find the Site-Specific Health and Safety Plan (HASP) for the Removal Assessment soil sampling and X-Ray Fluorescence (XRF) screening activities to be conducted at the Lake Erie Smelting Site located in Buffalo, Erie County, New York beginning on August 3, 2015. If you have any questions or comments, please do not hesitate to contact me at (603) 512-4350.

Sincerely,  
Weston Solutions, Inc.

Peter Lisichenko  
RST 3 Site Project Manager/Group Leader

Enclosure

cc: TDD File No.: TO-0006-0056

*an employee-owned company*

In association with Scientific and Environmental Associates, Inc.,  
Environmental Compliance Consultants, Inc., Avatar Environmental, LLC,  
On-Site Environmental, Inc., and Sovereign Consulting, Inc.





**REGION II RST 3 HEALTH AND SAFETY PLAN  
EMERGENCY RESPONSE/REMOVAL ASSESSMENT/REMOVAL ACTION  
(Revised 16 March 2011)**

**TDD No.:** TO-0006-0056

**Site Name:** Lake Erie Smelting Site

**Site Address:** Street: 400 Clinton Street  
City: Buffalo  
County/State: Erie County/New York

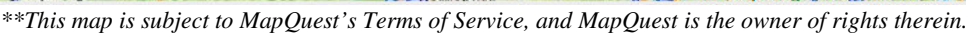
Directions to Site from Office (Color map is included on the following page):

1090 King Georges Post Rd  
Edison, NJ 08837

- |  |          |
|--|----------|
| 1. Head west toward King Georges Post Rd                                     | 289 ft   |
| 2. Turn left onto King Georges Post Rd                                       | 0.6 mi   |
| 3. Turn right onto Raritan Center Pkwy                                       | 256 ft   |
| Keep right at the fork, follow signs for Middlesex County                    |          |
| 514 E/Woodbridge Ave/I-287/NJ-440 and merge onto Woodbridge Ave              | 0.4 mi   |
| 4. Take the ramp onto I-287 N  | 0.8 mi   |
| 5. Merge onto I-287 N  | 20.4 mi  |
| 6. Take exit 21B on the left toward I-78 W/Easton Pa                         | 1.5 mi   |
| 7. Merge onto I-78 W (Partial toll road)                                     | 35.7 mi  |
| 8. Take exit 71 for PA-33 N toward US-22/Stroudsburg                         | 0.4 mi   |
| 9. Continue onto PA-33 N   | 22.4 mi  |
| 10. Continue onto PA-33 N/US-209 N   | 2.0 mi   |
| 11. Continue onto PA-33 N/Hwy 33 N   |          |
| (signs for W Interstate 80 W/Bartonsville/Hazleton)                          | 3.1 mi   |
| 12. Take the exit on the left onto I-80 W toward Hazleton                    | 9.0 mi   |
| 13. Keep right at the fork to continue on I-380 N, follow signs for Scranton | 28.3 mi  |
| 14. Merge onto I-81 N (Entering New York)                                    | 58.1 mi  |
| 15. Keep right to take I-81 N toward I-88 / Syracuse / Albany.               | 1.8 mi   |
| 16. Keep left to take I-81 N toward Syracuse.                                | 70.0 mi  |
| 17. Merge onto I-690 W toward Fairgrounds / Baldwinsville.                   | 8.8 mi   |
| 18. Take the I-90 exit, EXIT 1, toward Thruway.                              | 0.8 mi   |
| 19. Merge onto I-90 W / New York Trwy W toward Buffalo (Portions toll).      | 131.7 mi |
| 20. Merge onto NY-33 W / Kensington Expy W via EXIT 51W toward Buffalo.      | 6.8 mi   |
| 21. Merge onto Oak St / NY-33 via the exit on the left toward Oak St.        | 0.8 mi   |
| 22. Turn left onto William St / NY-354. Continue to follow William St.       | 0.6 mi   |
| 23. Turn right onto Hickory St.  | 0.09 mi  |
| 24. Turn Left onto Clinton St.   | 0.15 mi  |
| 25. 440 Clinton Street on the left.  |          |

440 Clinton Street  
Buffalo, New York 14204

**Destination is 381 miles; approximately 6 hours 7 minutes**



The Lake Erie Smelting Corporation (LES) is the location of a former secondary lead smelter that occupied approximately 13,000 square feet (ft<sup>2</sup>) at the historical address of 29 Superior Street in Buffalo, Erie County, New York. The footprint of the former facility currently lies north of Clinton Street and west of Jefferson Street within the Towne Gardens apartment complex and is now occupied by two of the Towne Gardens' apartment units.

Secondary lead smelting is the recovery of lead metal and alloys from scrap, including lead-acid batteries, lead cable coverings, plumbing, type metal, and wheel weights. The chief alloy recovered for many years by secondary smelters was antimonial lead. Besides scrapped batteries, sources of scrap included drosses (by-products of lead refining), battery plant scrap, old pipes or roof flashing, cable sheathing, solder, and Babbitt metal, which are a group of lead-tin-antimony alloys used as antifriction metals in wheel bearings. Near many stationary sources, such as smelters, lead concentrations in soil may reach very high percentage levels and may persist in the surface soils (*i.e.*, 0.8 to 2 inches). Lead in soil and dust is a primary source of environmental lead exposure. LES, which operated as a secondary smelter, may have been responsible for releasing large amounts of lead contamination into the surrounding environment for a time

period of approximately 30 years, from the mid-1930s to the mid-1960s. The facility also produced and consumed lead-tin-antimony alloys (*i.e.*, Babbitt metal); therefore, there was a potential for tin and antimony to be contained in any historical releases from the facility.

Towne Gardens is a residential apartment complex consisting of 360 total units. The housing units are surrounded by grass-covered lawns, concrete sidewalks, and asphalt-paved parking lots. The former LES facility footprint lies in the northeastern portion of the complex near Jefferson Avenue. Two of the residential apartment buildings and adjacent grass-covered areas occupy a portion of the footprint, as well as an attached single story building that appears to be an office. To the north of the footprint is one of the complex's parking lots and a commercial property. A residential area is located east and northeast of the Site.

According to available wind rose plots, the prevailing wind direction in Buffalo, New York is approximately southwest to northeast, indicating that a residential neighborhood is downwind of the former smelter location. Site topography is flat; runoff from the Site is likely intercepted by storm drains located within the parking lot located immediately north of the former LES facility footprint.

In October 2014, soil samples were collected by the U.S. Environmental Protection Agency's (EPA) Site Assessment Team (SAT) contractor. These samples were collected from off-site locations from the Towne Garden complex at both upwind (background) and downwind directions based on the wind rose plots. Collected at various intervals down to 24 inches below ground surface (bgs), samples were analyzed for EPA target analyte list (TAL) metals, including tin. Results from these samples indicate a greater than three-fold increase in concentrations between the upwind (background) and downwind samples. Furthermore, there were corresponding increases in antimony as well as tin results between the upwind and downwind samples, supporting a correlation to operations at LES.

### **RST 3 Scope of Work:**

A sampling grid pattern will be established throughout the Site with a decreasing frequency moving away from the footprint of the former smelter. Within and adjacent to the former smelter, the sampling grid will be 50 linear feet. Stepping 100 feet latterly to the West and South, the sampling grid will expend to 100 linear feet and the remainder of the Site grid spacing will be 200 linear feet. Due to the presence of impervious surfaces (*i.e.*, sidewalks, buildings, driveways, and parking lots) the actual placement of the sampling locations will be either eliminated or latterly offset resulting in irregular patterns.

Prior to field mobilization, utility damage prevention initiatives will be enacted. Tasks include filling notification with Dig Safely New York 811 service and reviewing available Site drawings. In addition, field teams will scan sample locations with a magnetometer prior to subsurface activities.

In accordance with EPA Environmental Response Team (ERT) Standard Operating Procedure (SOP) #2012<sup>1</sup>, discrete samples will be collected from each location from the following depth intervals: 0 to 1, 1 to 6, 6 to 12, 12 to 18, and 18 to 24 inches bgs. For the 0 to 1 and 1 to 6 interval, a "plug" of sod and soil will be extracted using a spade shovel. Approximately 8 ounces of material for each interval will be collected from this "plug" using dedicated plastic

---

<sup>1</sup> EPA ERT SOP# 2012: Soil Sampling

scoops, placed in separate 6 x 9 polyethylene bags and labeled accordingly. For the lower depth intervals, stainless steel hand augers will be used to advance down to depth for a particular depth interval. The cores will be emptied from the barrel of the auger into 10 x 12 polyethylene bags for homogenization. Once homogenized, 8 ounces of material will be extracted using dedicated plastic scoops, placed in a 6 x 9 polyethylene bags, and labeled accordingly. Fresh nitrile gloves will be donned for each sample collected. In accordance with ERT SOP #2006<sup>2</sup>, all non-dedicated sampling equipment (*i.e.*, hand augers) will be cleaned and washed using proper decontamination methods, including an industrial soap solution and clean water. To ensure effective decontamination of non-dedicated sampling equipment, an aqueous rinsate blank will be collected at the end of each day from a non-dedicated sampling tool used that day and will be submitted for target analyte list (TAL) metals, including tin, analysis.

All soil samples collected will be screened on-site using X-ray Fluorescence (XRF) technology. Prior to analysis, samples will be dried in on-site ovens to reduce moisture content of the samples. Analysis runs will be conducted over three 60-second intervals and averaged for a final result. Results for lead screening will be recorded for each sample and entered into EPA's SCRIBE data management system. Calibration checks will be conducted daily against calibration blanks supplied by the manufacture and documented. Up to 30 percent (%) confirmation sampling will be conducted whereby 30 % of the samples collected will be submitted to a Contract Laboratory Program (CLP) laboratory for TAL metals, including tin, analysis. Selection of these samples will be as directed by the EPA On-Scene Coordinator (OSC). Samples for laboratory analysis will be transferred to 8 ounce glass jars and all sampling information will be entered into EPA's SCRIBE data management system. Quality control/quality assurance (QA/QC) samples will be collected at a rate 1 per 20 samples. The analytical results will be compared to the field screening results and a correlation factor will be determined to evaluate the accuracy of the XRF analyzer.

All soil borings will be backfilled daily and locations will be restored to pre-sampling conditions as reasonably possible. Top soil and a mix grass seed blend may be used as needed for restoration purposes.

Based on the approach described above, the following quantities have been estimated for this assessment:

Total number of locations for sampling: 52

Total number of samples to be collected for field screening: 260

Total number of confirmation samples for laboratory analysis (including QA/QC): 82

Anticipated number of rinsate blanks (one per day of sampling): 4

**Four (4) S.M.A.R.T. Health and Safety Goals for the Project (Simple, Measurable, Actionable, Reasonable, & Timely):**

1. Safe driving practices, utilizing a spotter if necessary when backing out of the different areas of the parking lot.
2. Use caution and rotate job tasks to prevent strains and sprains while hand augering and carrying equipment.

---

<sup>2</sup> EPA ERT SOP# 2006: Sampling Equipment Decontamination

3. Safe operation of XRF instrument during on-site lead screening activities.
4. Aware of surrounding areas and walking surfaces, minimizing slips, trips, and falls.

**Incident Type:**

- ☐ Emergency Response
- ☒ Removal Assessment: Beginning on August 3, 2015
- ☐ Removal Action
- ☐ PRP Oversight
- ☐ Other

**Location Class:**

- ☒ Industrial
- ☒ Commercial
- ☒ Urban/Residential
- ☐ Rural

U.S. EPA OSC: David Rosoff

Original HASP: Yes

Lead RST 3: Peter Lisichenko

Date of Initial Site Activities: 8/3/2015

Site Health & Safety Coordinator: Peter Lisichenko

Site Health & Safety Alternate: Scott Snyder

**Response Activities/Dates of Response (fill in as applicable)**

**Emergency Response:**

- ☐ Perimeter Recon -
- ☐ Site Entry -
- ☐ Visual Documentation -
- ☐ Multi-Media Sampling -
- ☐ Decontamination -

**Removal Assessment:**

- ☒ Perimeter Recon: Beginning on August 3, 2015
- ☒ Site Entry: Beginning on August 3, 2015
- ☒ Visual Documentation: Beginning on August 3, 2015
- ☒ Soil Sampling: Beginning on August 3, 2015
- ☒ Decontamination: Beginning on August 3, 2015

**Removal Action:**

- ☐ Perimeter Recon
- ☐ Site Entry
- ☐ Visual Documentation
- ☐ Multi-Media Sampling
- ☐ Decontamination

**Physical Safety Hazards to Personnel:**

- |   |   |   |
|---|---|---|
| <input checked="" type="checkbox"/> Inclement Weather – Attach FLD02          | <input checked="" type="checkbox"/> Heat – Attach FLD05               | <input type="checkbox"/> Cold – Attach FLD06                                      |
| <input type="checkbox"/> Confined Space – Attach FLD08                        | <input type="checkbox"/> Industrial Trucks – Attach FLD09             | <input checked="" type="checkbox"/> Manual Lifting – Attach FLD10                 |
| <input checked="" type="checkbox"/> Terrain – Attach FLD11                    | <input type="checkbox"/> Structural Integrity – Attach FLD13          | <input type="checkbox"/> Site Security – Attach FLD14                             |
| <input type="checkbox"/> Pressurized Containers, Systems – Attach FLD16       | <input type="checkbox"/> Use of Boats – Attach FLD18                  | <input type="checkbox"/> Waterways – Attach FLD19                                 |
| <input type="checkbox"/> Explosives – Attach FLD21                            | <input type="checkbox"/> Heavy Equipment – Attach FLD22               | <input type="checkbox"/> Aerial Lifts and Manlifts – Attach FLD24                 |
| <input type="checkbox"/> Elevated Surfaces and Fall Protection – Attach FLD25 | <input type="checkbox"/> Ladders – Attach FLD26                       | <input type="checkbox"/> Excavations/Trenching – Attach FLD28                     |
| <input type="checkbox"/> Fire Prevention – Attach FLD31                       | <input type="checkbox"/> Demolition – Attach FLD33                    | <input checked="" type="checkbox"/> Underground/Overhead Utilities – Attach FLD34 |
| <input checked="" type="checkbox"/> Hand and Power Tools – Attach FLD38       | <input type="checkbox"/> Illumination – Attach FLD39                  | <input type="checkbox"/> Storage Tanks – Attach FLD40                             |
| <input checked="" type="checkbox"/> Lead Exposure – Attach FLD46              | <input checked="" type="checkbox"/> Sample Storage – Attach FLD49     | <input type="checkbox"/> Cadmium Exposure – Attach FLD50                          |
| <input type="checkbox"/> Asbestos Exposure – Attach FLD52                     | <input type="checkbox"/> Hexavalent Chromium Exposure – Attach FLD 53 | <input type="checkbox"/> Benzene Exposure – Attach FLD 54                         |
| <input type="checkbox"/> Drilling Safety – Attach FLD56                       | <input type="checkbox"/> Drum Handling – Attach FLD58                 | <input type="checkbox"/> Gasoline Contaminant Exposure – Attach FLD61             |
| <input type="checkbox"/> Noise – Attach CECHSP, Section 7                     | <input checked="" type="checkbox"/> Walking/Working Surfaces          | <input type="checkbox"/> Oxygen Deficiency  |
| <input type="checkbox"/> Unknowns in Tanks or Drums                           | <input type="checkbox"/> Nonionizing Radiation                        | <input checked="" type="checkbox"/> Ionizing Radiation                            |

### **Biological Hazards to Personnel:**

- |   |  |
|---|--|
| <input type="checkbox"/> Infectious/Medical/Hospital Waste – Attach FLD 44 and 45 | <input checked="" type="checkbox"/> Non-domesticated Animals – Attach RST 3 FLD43      |
| <input checked="" type="checkbox"/> Insects – Attach RST 3 FLD 43                 | <input checked="" type="checkbox"/> Poisonous Plants/Vegetation – Attach RST 3 FLD 43D |
| <input type="checkbox"/> Raw Sewage   | <input type="checkbox"/> Bloodborne Pathogens – Attach FLD 44 and 45                   |

### **Training Requirements:**

- |   |  |
|---|--|
| <input checked="" type="checkbox"/> 40-Hour HAZWOPER Training with three days supervised experience | <input type="checkbox"/> 8-Hour Management or Supervisor Training in addition to basic training course |
| <input checked="" type="checkbox"/> 8-Hour Annual Refresher Health and Safety Training              | <input type="checkbox"/> Site Specific Health and Safety Training                                      |
| <input type="checkbox"/> DOT (CMV Training - ERV in Use)  | <input type="checkbox"/> Bio-Medical Collection and Response   |

### **Medical Surveillance Requirements:**

- |   |   |
|---|---|
| <input checked="" type="checkbox"/> Baseline initial physical examination with physician certification  | <input checked="" type="checkbox"/> Annual medical examination with physician certification |
| <input checked="" type="checkbox"/> Site-specific medical monitoring protocol (Radiation, Heavy Metals) | <input type="checkbox"/> Asbestos worker medical protocol                                   |

### **Vehicle Use Assessment and Selection:**

Driving is one of the most hazardous and frequent activities for Weston Employees. As such, Weston Employees are required to adhere to established safe operating practices in order to maintain their eligibility to drive Weston owned, leased, or rented vehicles. Every person riding in a Weston vehicle, including passengers must maintain a commitment for a safe journey. This means being attentive while in the vehicle and helping the driver to notice hazards ahead of and around the vehicle and ensure that their presence does not distract the driver from safely operating the vehicle.

A high percentage of vehicle accidents occur when operating in reverse. Anytime a vehicle is operated in reverse, e.g., backing out of a parking area, if there are passengers, at least one of them are to assist the driver by acting as a guide person during the reverse movement or during other vehicle operation where it would be prudent to have a guide person(s) participate in the vehicle movement. When practical, the preferred parking method would be to back into the parking area.

At a minimum, each Weston Driver must:

- Possess a current, valid drivers' license
- Current Commercial Motor Vehicle (CMV) card when operating the Emergency Response Vehicle
- Obey posted speed limits and traffic laws
- Wear seat belts at all times while the vehicle is in operation
- Conduct a 360 degree inspection around the vehicle before attempting to drive the vehicle
- Report accidents / incidents immediately and complete a Notice of Incident (NOI)
- Keep vehicles on approved roadways (4WD does not guarantee mobility on unapproved surfaces)

All Region II RST 3 personnel are experienced and qualified to drive RST 3 fleet vehicles (Tahoe, Suburbans, Minivan/Cargo Van, and Emergency Response Vehicle). However, in the event that vehicle rental is required, each person must take the time to familiarize themselves with that particular vehicle. This familiarization includes adjustment of the dashboard knobs/controls, mirrors, steering wheel, seats, and a 360 degree external inspection of the vehicle.

1. The following vehicles are anticipated to be used on this project:

- |   |   |
|---|---|
| <input type="checkbox"/> Car  | <input type="checkbox"/> Pickup Truck   |
| <input type="checkbox"/> Intermediate/Standard SUV<br>(e.g. Chevy Trailblazer, Chevy Tahoe, Ford Explorer, Ford Escape) | <input checked="" type="checkbox"/> Full Size SUV (e.g. Chevy Suburban, Ford Expedition, GMC Yukon) |
| <input checked="" type="checkbox"/> Minivan/Cargo Van (e.g. Chevy Uplander, Chevy Express Van)                          | <input type="checkbox"/> Box Truck (Size: _____)  |
| <input type="checkbox"/> Emergency Response Vehicle (ERV)   | <input type="checkbox"/> Other _____  |

2. Are there any on-site considerations that should be noted:

- |  |   |  |  |
|--|---|--|--|
| <input checked="" type="checkbox"/> Working/Driving Surfaces | <input type="checkbox"/> Debris                             | <input type="checkbox"/> Overhead Clearance              | <input type="checkbox"/> Obstructions        |
| <input type="checkbox"/> Tire Puncture Hazards               | <input type="checkbox"/> Vegetation                         | <input type="checkbox"/> Terrain                         | <input checked="" type="checkbox"/> Parking  |
| <input type="checkbox"/> Congestion                          | <input checked="" type="checkbox"/> Site Entry/Exit Hazards | <input checked="" type="checkbox"/> Local Traffic Volume | <input checked="" type="checkbox"/> Security |
| <input type="checkbox"/> Heavy Equipment                     | <input type="checkbox"/> Time/Length of Work Day            | <input type="checkbox"/> Other:                          |  |

Do any of the considerations above require further explanation: No



3. Was the WESTON Environmental Risk Management Tool completed in EHS? Yes

Was an Environmental Compliance Plan required? No

4. Are there any seasonal considerations that should be noted (e.g., Anticipated Snowy Conditions): No

5. Is a Traffic Control Plan required? ☐ Yes ☒ No

## Chemical Hazards to Personnel

Physical Parameters	Chemical Contaminant Lead CAS #7439-92-1	Nitric Acid Solution CAS # 7697-37-2
Exposure Limits IDLH Level	_____ ppm <u>0.050</u> mg/m <sup>3</sup> PEL _____ ppm <u>0.050</u> mg/m <sup>3</sup> TLV / REL _____ ppm <u>100</u> mg/m <sup>3</sup> IDLH	_____ ppm <u>5.0</u> mg/m <sup>3</sup> PEL _____ ppm <u>5.0</u> mg/m <sup>3</sup> TLV / REL _____ ppm <u>25</u> mg/m <sup>3</sup> IDLH
Physical Form (Solid/Liquid/Gas)	<u>  X  </u> Solid _____ Liquid _____ Gas	_____ Solid <u>  X  </u> Liquid _____ Gas
Color	A heavy, ductile, soft, gray solid color	Clear colorless to yellow liquid
Odor	Odorless	Pungent
Flash Point Flammable Limits	<u>  N/A  </u> Degrees F or C <u>  NA  </u> % UEL <u>  NA  </u> % LEL	<u>  N/A  </u> Degrees F or C <u>  NA  </u> % UEL <u>  NA  </u> % LEL
Vapor Pressure Vapor Density	<u>  0  </u> mm/Hg <u>  NA  </u> Air = 1	<u>  48  </u> mm/Hg <u>  NA  </u> Air = 1
Specific Gravity	<u>  11.34  </u> Water = 1	<u>  1.4  </u> Water = 1
Solubility	Insoluble	Miscible
Incompatible Material	Strong Oxidizers, hydrogen peroxide, acids	Combustible materials, metallic powders, hydrogen sulfide, carbides, and alcohols [Note: Reacts with water to produce heat. Corrosive to metals.]
Routes of Exposure	<u>  X  </u> Inh _____ Abs <u>  X  </u> Con <u>  X  </u> Ing	<u>  X  </u> Inh _____ Abs <u>  X  </u> Con <u>  X  </u> Ing
Symptoms of Acute Exposure	Lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia; weight loss; malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; irritation eyes, hypertension	irritation eyes, skin, mucous membrane; delayed pulmonary edema, pneumonitis, bronchitis; dental erosion
First Aid Treatment	<b>Eye:</b> Irrigate immediately <b>Skin:</b> Soap wash immediately <b>Breathing:</b> Respiratory support <b>Swallow:</b> Medical attention immediately	<b>Eye:</b> Irrigate immediately <b>Skin:</b> Water flush immediately <b>Breathing:</b> Respiratory support <b>Swallow:</b> Medical attention immediately
Ionization Potential	<u>  N/A  </u> eV	<u>  11.95  </u> eV
Instruments for Detection	_____ PID w/ _____ Probe _____ FID _____ CGI _____ RAD _____ Det Tube _____ Lumex <u>  X  </u> Other NIOSH 7082, NIOSH 7300	<u>  X  </u> PID w/ _____ Probe _____ FID _____ CGI _____ RAD _____ Det Tube <u>  X  </u> Other (pH papers) _____ Lumex NIOSH 7082, NIOSH 7300

**Site Map with Work Zones:** Work zones will be determined on-site during project initiation.



\*\*This map is subject to Google's Terms of Service, and Google is the owner of rights therein.

### Work Zone Definitions:

**Exclusion Zone:** The area where contamination is either known or expected to occur and the greatest potential for exposure exists. The outer boundary of the Exclusion Zone, called the Hotline, separates the area of contamination from the rest of the Site.

**Contamination Reduction Zone (CRZ):** The area in which decontamination procedures take place. The purpose of the CRZ is to reduce the possibility that the Support Zone will become contaminated or affected by the site hazards.

**Support Zone:** The uncontaminated area where workers are unlikely to be exposed to hazardous substances or dangerous conditions. The Support Zone is the appropriate location for the command post, medical station, equipment and supply center, field laboratory, and any other administrative or support functions that are necessary to keep site operations running efficiently.

### Communications:

- |                                     |                          |                                     |                             |
|-------------------------------------|--------------------------|-------------------------------------|-----------------------------|
| <input checked="" type="checkbox"/> | Buddy System             | <input checked="" type="checkbox"/> | Radio                       |
| <input type="checkbox"/>            | Air Horn for Emergencies | <input checked="" type="checkbox"/> | Hand Signals/Visual Contact |

**Personnel Decontamination Procedures:**

- ☐ Wet Decontamination (procedures as follows)
- ☒ Dry Decontamination (procedures as follows)

All Removal Assessment sampling activities will be conducted in Modified Level D personal protective equipment (PPE). All used PPE will be grossly decontaminated and disposed of in accordance with applicable federal, state, and local regulations.

**Equipment Decontamination Procedures:**

- ☐ None
- ☒ Wet Decontamination (procedures as follows)
- ☐ Dry Decontamination (procedures as follows)

It is anticipated that dedicated sampling equipment will be utilized during soil sample collection activities. However, if non-dedicated sampling equipment, including hand augers and shovels, is utilized it will be decontaminated on-site as follows:

1. Alconox/portable water scrub
2. Deionized water rinse
3. Solvent rinse
4. Deionized water rinse
5. Air Dry

Refer to EPA ERT SOP#: 2006 – Sampling Equipment Decontamination.

Per the direction of the EPA OSC, all decontamination fluids, if used, will be disposed of on-site. All disposable sampling equipment will be void of gross contamination, double bagged, and disposed of in accordance with applicable federal, state, and local regulations.

Adequacy of decontamination determined by: RST 3 Health and Safety Officer

### Personal Protective Equipment

TASK TO BE PERFORMED	ANTICIPATED LEVEL OF PROTECTION	TYPE OF CHEMICAL PROTECTIVE COVERALL	INNER GLOVE / OUTER GLOVE / BOOT COVER	APR CARTRIDGE TYPE or SCBA
On-site Reconnaissance	Level D	None	Nitrile/Latex boot covers/ Steel Toe Boots/Hard Hat/Safety Glasses	None
Soil Sampling/XRF screening of soil samples	Modified Level D	Tyvek© or long sleeved shirts and pants should be worn if poisonous plants are present.	Blue Nitrile/Green Nitrile/ Latex Booties/Steel Toe Boots/Hard Hat/Safety Glasses	None
Site Documentation	Level D	None	Nitrile Gloves/Latex boot covers	None

### Hazard Task Analysis

RISK LEVEL (High, Medium, Low)	HAZARD	RECOGNITION/ SYMPTOMS	MITIGATION	LEVEL OF PROTECTION
Medium	Strains and sprains from manual lifting and sample collection (i.e., use of hand auger)	Objects heavier than 35 pounds, large and oddly shaped objects regardless of weight, pinch points and tight spaces, wet or slippery surfaces.	<ul style="list-style-type: none"> <li>• Use proper lifting techniques such as keeping straight back, lifting with legs, avoid twisting back.</li> <li>• Use mechanical equipment or get help from others.</li> <li>• Ensure that all samplers are familiar with the tools and equipment selected for sample collection.</li> <li>• All samplers should be able to demonstrate to the sampling lead they are familiar with the tools and their function.</li> <li>• Rotate task among workers so no one worker is collecting all the samples. Allow for rest breaks.</li> <li>• See FLD 10.</li> </ul>	Level D
Low	Biological Hazards	Activities conducted outdoors have the potential for contact with poisonous plants, insects, and snakes in addition to potential contact with other animals. This sampling event requires RST 3 staff to enter private residential yards where domesticated animals may be encountered.	<ul style="list-style-type: none"> <li>• Residents shall be contacted prior to entering private yards.</li> <li>• Workers entering yards should be alert for animals.</li> <li>• If an aggressive animal is encountered, remain calm, back away slowly, and vacate the area.</li> </ul>	Level D

### Hazard Task Analysis (Concluded)

<b>RISK LEVEL (High, Medium, Low)</b>	<b>HAZARD</b>	<b>RECOGNITION/ SYMPTOMS</b>	<b>MITIGATION</b>	<b>LEVEL OF PROTECTION</b>
Low	Exposure to contaminants	Contact with contaminated soil and dirty or leaking sample containers.	<ul style="list-style-type: none"> <li>• Wear required PPE, including nitrile gloves, as specified in this HASP.</li> <li>• Follow all equipment decontamination procedures for reusable equipment.</li> <li>• Handle all glassware with care. Bottles may break if dropped; use leather gloves when cleaning up broken glass.</li> <li>• Ensure that each container top is securely tightened. Pack each container in a manner to prevent damage to container during handling of shipping box and during transportation.</li> </ul>	Level D
Low	XRF Operation	Exposure to ionizing radiation.	<ul style="list-style-type: none"> <li>• Operation of XRF in accordance with manufacturer's instructions (see Attachment B).</li> <li>• Appropriate operator dosimetry.</li> <li>• Establish operation/controlled zone to prevent exposure by the public and other site workers.</li> </ul>	Level D
Medium	Temperature extremes (heat stress)	<p>See FLD05. Some symptoms of <b>heat exhaustion</b> include pale, clammy, and moist skin; profuse sweating; weakness; weak rapid pulse and shallow breathing.</p> <p>Some symptoms of <b>heat stroke</b> include red, hot dry skin; nausea; dizziness; confusion; extremely high body temperature; rapid seizures and pulse; seizure/convulsions.</p>	<ul style="list-style-type: none"> <li>• Wear clothing/PPE suitable for weather and working conditions.</li> <li>• Keep an eye on your working buddy for signs of heat stress.</li> <li>• Appropriate work/rest schedule</li> <li>• Drink fluids and rest when needed.</li> </ul>	Level D
Low	Slips, trips, falls around uneven surfaces	Unsure or unstable footing and walking, safely navigate walking/working surfaces.	<ul style="list-style-type: none"> <li>• Visually inspect work areas and mark, barricade, or eliminate slip, trip, and fall hazards.</li> <li>• Avoid walking uneven surfaces, if possible.</li> </ul>	Level D
Low	Driving	Vehicular loss of control i.e. swerving or skidding into traffic or pedestrians.	<ul style="list-style-type: none"> <li>• Maintain eyes on road while moving; check rear view mirrors and side mirrors when backing up and changing lanes.</li> <li>• Wear seat belt and make sure there is a line of sight in all directions.</li> </ul>	Seat Belt and Driver Airbags

Frequency and Types of Air Monitoring: None

☐ Continuous- \_\_\_\_\_ ☐ Routine - \_\_\_\_\_ ☐ Periodic - \_\_\_\_\_

DIRECT READING INSTRUMENTS	MultiRAE CGI / O <sub>2</sub> / H <sub>2</sub> S / CL <sub>2</sub> / CO / PID	Ludlum 19 Micro-R Meter / Ludlum Model 3 Survey Meter	MicroFID or TVA-1000	Drager Chemical Detector Tube	<u>XRF</u>
EQUIPMENT ID NUMBER	N/A	N/A	N/A	N/A	TBD
CALIBRATION DATE	N/A	N/A	N/A	N/A	TBD
RST 3 PERSONNEL	N/A	N/A	N/A	N/A	TBD
ACTION LEVEL	> 10 - 20% LEL (Confined Space / non- Confined Space)  < 19.5% O <sub>2</sub> Deficient > 23% O <sub>2</sub> – Enriched  H <sub>2</sub> S – PEL: 20 ppm IDLH: 100 ppm  Cl <sub>2</sub> – PEL: 1 ppm IDLH: 10 ppm	<3X Background Exercise Caution;  ≥ 1 mR/HR – Exit Area, Establish Perimeter, Contact RST 3 HSO	Unknowns:  1 - 5 Units - "Level C"  5-500 Units- "Level B"	PEL / TLV / IDLH: Compare with Drager Tube	N/A

### Emergency Telephone Numbers

Emergency Contact	Location / Address	Telephone Number	Notified
<b>Hospital</b>	Buffalo General Hospital 100 High Street, Buffalo, NY 14203	Emergency: 911 Non-emergency: (716) 859-5600	No
<b>Police</b>	Buffalo Police Department 695 Main St Buffalo, NY 14203	Emergency: 911 Non-emergency: (716) 851-4403	No
<b>Fire Department</b>	Buffalo Fire Department 132 Ellicott St Buffalo, NY 14203	Emergency: 911 Non-emergency: (716) 851-5333	No

Chemical Trauma Capability? ☒ Yes ☐ No

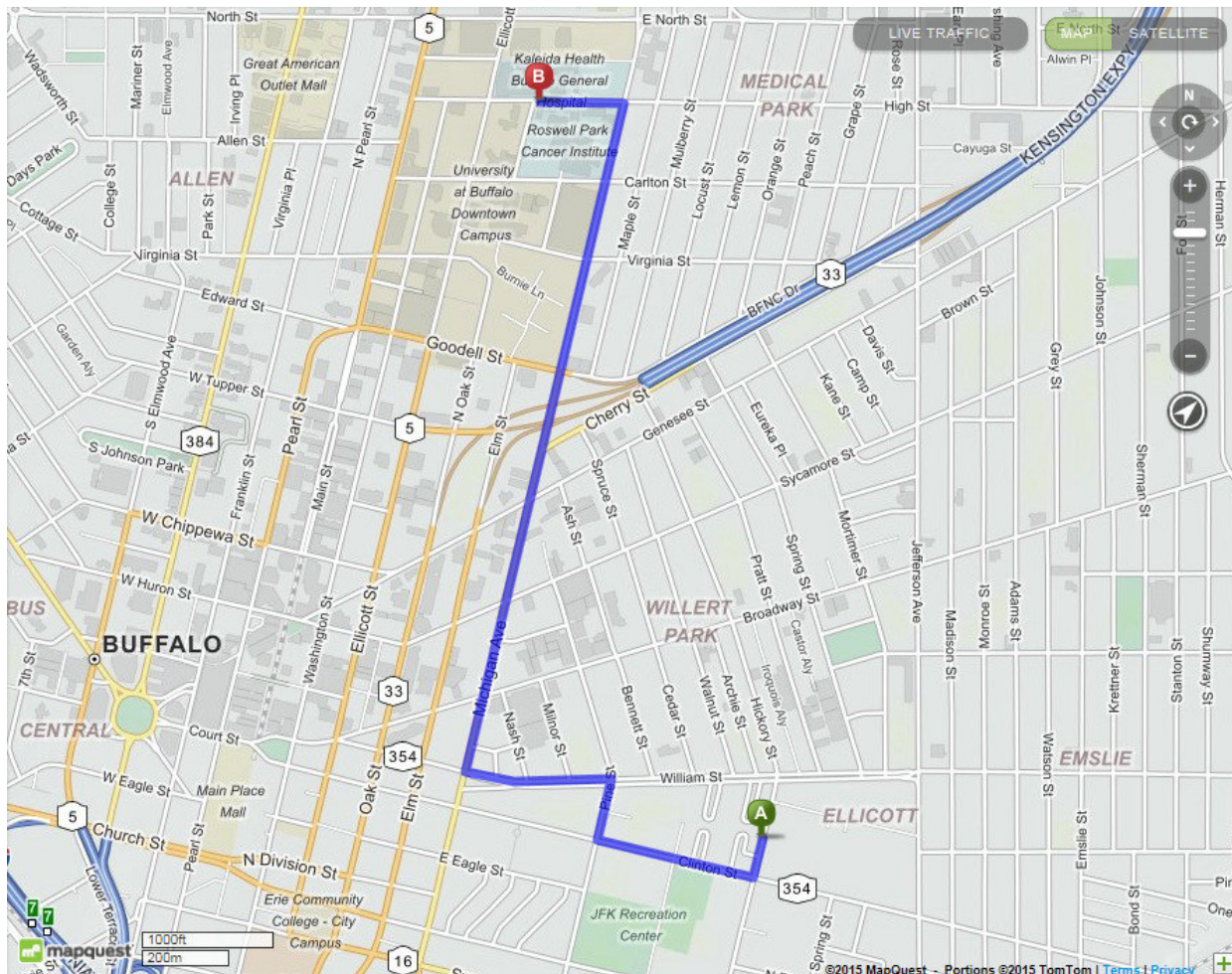
If no, closest backup: \_\_\_\_\_ Phone: \_\_\_\_\_



## Directions to Buffalo General Hospital

1. Start out going south on Hickory St toward Cambridge Ct. 0.06 mi
2. Take the 2nd right onto Clinton St / NY-354. 0.3 mi
3. Turn right onto Pine St / NY-354. 0.10 mi
4. Take the 1st left onto William St / NY-354. 0.2 mi
5. Turn right onto Michigan Ave. 1.1 mi
6. Turn left onto High St. 0.1 mi
7. 100 HIGH ST is on the right.

**Total Travel Estimate: Approximately 5 minutes 1.86 miles**



*\*\*This map is subject to Google's Terms of Service, and Google is the owner of rights therein.*

Route verified by: \_\_\_\_\_

Date: \_\_\_\_\_



### Additional Emergency Telephone Contacts

<b>WESTON Medical Emergency Service</b> Dr. Peter Greaney, Medical Director WorkCare 300 South Harbor Blvd, Suite 600 Anaheim, California 92805	800-455-6155 Regular Business Hours (9AM to 7:30PM) <b>Dial 0 or Ext. 175 for Michelle Bui to request the on-call clinician.</b> 800-455-6155 After Hours (Weekdays 7:31PM to 8:59AM, Weekends, Holidays) <b>Dial 3 to reach the after-hours answering service. Request that the service connect you with the on-call clinician or the on-call clinician will return your call within 30 minutes.</b>
Chemtrec	800-424-9300
ATSDR	404-639-0615
ATF (explosives information)	800-424-9555
National Response Center	800-424-8802
National Poison Control Center	800-764-7661
<b>Chemtel</b>	800-255-3924
DOT	800-424-8802
CDC	800-232-0124

### Pre-Response Approval

HASP prepared by: Michael Garibaldi

Date: 7/24/2015

Pre-Response/Entry Approval by:  \_\_\_\_\_

Date: 7/24/2015

Tasks Conducted	Level of Protection/Specific PPE Used
On-site Reconnaissance	Level D/Blue Nitrile/Latex Booties/Steel Toe Boots/Hard Hat/Safety Glasses
Soil Sampling/XRF screening of soil samples	Level D/Blue Nitrile/Steel Toe Boots/Safety Glasses/Appropriate Dosimetry
Sample Documentation	Level D/Blue Nitrile/Latex Booties/Steel Toe Boots/Hard Hat/Safety Glasses

## Hazardous Waste Site and Environmental Sampling Activities

Off Site:    ☐ Yes    ☒ No

On Site:    ☒ Yes    ☐ No

Describe types of samples and methods used to obtain samples:

A sampling grid pattern will be established throughout the Site with a decreasing frequency moving away from the footprint of the former smelter. Within and adjacent to the former smelter, the sampling grid will be 50 linear feet. Stepping 100 feet latterly to the West and South, the sampling grid will expend to 100 linear feet and the remainder of the Site grid spacing will be 200 linear feet. Due to the presence of impervious surfaces (*i.e.*, sidewalks, buildings, driveways, and parking lots) the actual placement of the sampling locations will be either eliminated or latterly offset resulting in irregular patterns.

Prior to field mobilization, utility damage prevention initiatives will be enacted. Tasks include filling notification with Dig Safely New York 811 service and reviewing available Site drawings. In addition, field teams will scan sample locations with a magnetometer prior to subsurface activities.

In accordance with EPA ERT SOP #2012, discrete samples will be collected from each location from the following depth intervals: 0 to 1, 1 to 6, 6 to 12, 12 to 18, and 18 to 24 inches bgs. For the 0 to 1 and 1 to 6 interval, a “plug” of sod and soil will be extracted using a spade shovel. Approximately 8 ounces of material for each interval will be collected from this “plug” using dedicated plastic scoops, placed in separate 6 x 9 polyethylene bags and labeled accordingly. For the lower depth intervals, stainless steel hand augers will be used to advance down to depth for a particular depth interval. The cores will be emptied from the barrel of the auger into 10 x 12 polyethylene bags for homogenization. Once homogenized, 8 ounces of material will be extracted using dedicated plastic scoops, placed in a 6 x 9 polyethylene bags, and labeled accordingly. Fresh nitrile gloves will be donned for each sample collected. In accordance with ERT SOP #2006, all non-dedicated sampling equipment (*i.e.*, hand augers) will be cleaned and washed using proper decontamination methods, including an industrial soap solution and clean water. To ensure effective decontamination of non-dedicated sampling equipment, an aqueous rinsate blank will be collected at the end of each day from a non-dedicated sampling tool used that day and will be submitted for TAL metals, including tin, analysis.

All soil samples collected will be screened on-site using XRF technology. Prior to analysis, samples will be dried in on-site ovens to reduce moisture content of the samples. Analysis runs will be conducted over three 60-second intervals and averaged for a final result. Results for lead screening will be recorded for each sample and entered into EPA’s SCRIBE data management system. Calibration checks will be conducted daily against calibration blanks supplied by the manufacture and documented. Up to 30 % confirmation sampling will be conducted whereby 30 % of the samples collected will be submitted to a CLP laboratory for TAL metals, including tin, analysis. Selection of these samples will be as directed by the EPA OSC. Samples for laboratory analysis will be transferred to 8 ounce glass jars and all sampling information will be entered into EPA’s SCRIBE data management system. QA/QC samples will be collected at a

rate 1 per 20 samples. The analytical results will be compared to the field screening results and a correlation factor will be determined to evaluate the accuracy of the XRF analyzer.

All soil borings will be backfilled daily and locations will be restored to pre-sampling conditions as reasonably possible. Top soil and a mix grass seed blend may be used as needed for restoration purposes.

Based on the approach described above, the following quantities have been estimated for this assessment:

Total number of locations for sampling: 52

Total number of samples to be collected for field screening: 260

Total number of confirmation samples for laboratory analysis (including QA/QC): 82

Anticipated number of rinsate blanks (one per day of sampling): 4

Was laboratory notified of potential hazard level of samples?



Yes



No

Note: The nature of the work assignment may require the use of the following procedures/programs which will be included as attachments to this Health and Safety Plan (HASP) as applicable: Emergency Response Plan, Confined Space entry Procedures, Spill Containment Program.

Disclaimer: This HASP was prepared for work to be conducted under the RST 3 Contract EP-S2-14-01. Use of this HASP by WESTON and its subcontractors is intended to fulfill the OSHA requirements found in 29 CFR 1910.120. Items not specifically covered in this HASP are included by reference to 29 CFR 1910 and 1926.

The signatures below indicate that the individuals have read and understood this Health and Safety Plan.

PRINTED NAME	SIGNATURE	AFFILIATION	DATE

**Post-Response Approval**

Final Submission of HASP by:		Date:
Post Response Approval by:		Date:
RST 3 HSO Review by:		Date:

## Air Monitoring Summary Log

Date: \_\_/\_\_/\_\_

Data Collected by: \_\_\_\_\_

Station/Location	CGI / O <sub>2</sub> Meter / CL <sub>2</sub> / H <sub>2</sub> S	PID	FID / TVA-1000	DustTrak	Other (_____)

**ATTACHMENT A**  
**NIOSH POCKET GUIDES**



Centers for Disease Control and Prevention  
CDC 24/7: Saving Lives. Protecting People.™

## Search the Pocket Guide

Enter search terms separated by spaces.

### Lead

**Synonyms & Trade Names** Lead metal, Plumbum

<b>CAS No.</b> 7439-92-1	<b>RTECS No.</b> <u>OF7525000</u> ( <a href="http://niosh-rtecs/OF72D288.html">/niosh-rtecs/OF72D288.html</a> )	<b>DOT ID &amp; Guide</b>
<b>Formula</b> Pb	<b>Conversion</b>	<b>IDLH</b> 100 mg/m <sup>3</sup> (as Pb) See: <u>7439921</u> ( <a href="http://niosh/idlh/7439921.html">/niosh/idlh/7439921.html</a> )

#### Exposure Limits

**NIOSH REL** \*: TWA (8-hour) 0.050 mg/m<sup>3</sup> See Appendix C ([nengapdx.html](http://nengapdx.html)) [\*Note: The REL also applies to other lead compounds (as Pb) -- see Appendix C.]

**OSHA PEL** \*: [1910.1025] TWA 0.050 mg/m<sup>3</sup> See Appendix C ([nengapdx.html](http://nengapdx.html)) [\*Note: The PEL also applies to other lead compounds (as Pb) -- see Appendix C.]

#### Measurement Methods

**NIOSH 7082** ([/niosh/docs/2003-154/pdf/7105.pdf](http://niosh/docs/2003-154/pdf/7105.pdf)), **7300** ([/niosh/docs/2003-154/pdfs/7300.pdf](http://niosh/docs/2003-154/pdfs/7300.pdf)), **7301** ([/niosh/docs/2003-154/pdfs/7301.pdf](http://niosh/docs/2003-154/pdfs/7301.pdf)), **7303** ([/niosh/docs/2003-154/pdfs/7303.pdf](http://niosh/docs/2003-154/pdfs/7303.pdf)), **7700** ([/niosh/docs/2003-154/pdfs/7700.pdf](http://niosh/docs/2003-154/pdfs/7700.pdf)), **7701** ([/niosh/docs/2003-154/pdfs/7701.pdf](http://niosh/docs/2003-154/pdfs/7701.pdf)), **7702** ([/niosh/docs/2003-154/pdfs/7702.pdf](http://niosh/docs/2003-154/pdfs/7702.pdf)), **9100** ([/niosh/docs/2003-154/pdfs/9100.pdf](http://niosh/docs/2003-154/pdfs/9100.pdf)), **9102** ([/niosh/docs/2003-154/pdfs/9102.pdf](http://niosh/docs/2003-154/pdfs/9102.pdf)), **9105** ([/niosh/docs/2003-154/pdfs/9105.pdf](http://niosh/docs/2003-154/pdfs/9105.pdf));

#### OSHA ID121

(<http://www.osha.gov/dts/sltc/methods/inorga>)  
 (<http://www.cdc.gov/Other/disclaimer.html>)  
(<http://www.osha.gov/dts/sltc/methods/inorga>)  
 (<http://www.cdc.gov/Other/disclaimer.html>)  
(<http://www.osha.gov/dts/sltc/methods/inorga>)  
 (<http://www.cdc.gov/Other/disclaimer.html>)  
See: NMAM ([/niosh/docs/2003-154/](http://niosh/docs/2003-154/)) or OSH (<http://www.osha.gov/dts/sltc/methods/index>)  
(<http://www.cdc.gov/Other/disclaimer.html>)

**Physical Description** A heavy, ductile, soft, gray solid.

<b>MW:</b> 207.2	<b>BP:</b> 3164° F	<b>MLT:</b> 621°F	<b>Sol:</b> Insoluble	<b>VP:</b> 0 mmHg (approx)
<b>Sp.Gr:</b> 11.34	<b>Fl.P:</b> NA	<b>UEL:</b> NA	<b>LEL:</b> NA	

Noncombustible Solid in bulk form.

**Incompatibilities & Reactivities** Strong oxidizers, hydrogen peroxide, acids

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, maln abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopat irritation eyes; hypertension

**Target Organs** Eyes, gastrointestinal tract, central nervous system, kidneys, blood, gingival tissue

**Personal Protection/Sanitation** (See protection codes (protect.html))

**Skin:** Prevent skin contact

**Eyes:** Prevent eye contact

**Wash skin:** Daily

**Remove:** When wet or contaminated

**Change:** Daily

**First Aid** (See procedures (firstaid.html))

**Eye:** Irrigate immediately

**Skin:** Soap flush promptly

**Breathing:** Respiratory support

**Swallow:** Medical attention immediately

#### **Respirator Recommendations**

(See Appendix E) (nengapdx.html)

#### **NIOSH/OSHA**

##### **Up to 0.5 mg/m<sup>3</sup>:**

(APF = 10) Any air-purifying respirator with an N100, R100, or P100 filter (including N100, R filtering facepieces) except quarter-mask respirators.

Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.

(APF = 10) Any supplied-air respirator

##### **Up to 1.25 mg/m<sup>3</sup>:**

(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

(APF = 25) Any powered, air-purifying respirator with a high-efficiency particulate filter.

##### **Up to 2.5 mg/m<sup>3</sup>:**

(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.

Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.

(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a co

(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-effic

(APF = 50) Any self-contained breathing apparatus with a full facepiece

(APF = 50) Any supplied-air respirator with a full facepiece

##### **Up to 50 mg/m<sup>3</sup>:**

(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pre

##### **Up to 100 mg/m<sup>3</sup>:**

(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressur positive-pressure mode

##### **Emergency or planned entry into unknown concentrations or IDLH conditions:**

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operate demand or other positive-pressure mode



(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus.

**Escape:**

(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.

[Click here \(pgintrod.html#npr\)](#) for information on selection of N, R, or P filters.

Any appropriate escape-type, self-contained breathing apparatus

[Important additional information about respirator selection \(pgintrod.html#mustread\)](#)

---

See also: [INTRODUCTION \(/niosh/npg/pgintrod.html\)](#) See ICSC CARD: [0052 \(/niosh/ipcsneng/MEDICAL TESTS: 0127 \(/niosh/docs/2005-110/nmed0127.html\)](#)

---

---

Page last reviewed: April 4, 2011

Page last updated: November 18, 2010

Content source: [National Institute for Occupational Safety and Health \(NIOSH\)](#) Education and Information Division

---

Centers for Disease Control and Prevention 1600 Clifton Rd. Atlanta, GA 30333, USA

800-CDC-INFO (800-232-4636) TTY: (888) 232-6348 - [cdcinfo@cdc.gov](mailto:cdcinfo@cdc.gov)



## Search the Pocket Guide

Enter search terms separated by spaces.

# Nitric acid

**Synonyms & Trade Names** Aqua fortis, Engravers acid, Hydrogen nitrate, Red fuming nitric acid (RFNA), White fuming nitric acid (WFNA)

**CAS No.** 7697-37-2

**RTECS No.** QU5775000  
([niosh-rtecs/QU581E98.html](http://niosh-rtecs/QU581E98.html))

**DOT ID & Guide** 2031 157 (<http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=157>) (other than red fuming)  
2032 157 (<http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=157>) (fuming)

**Formula** HNO<sub>3</sub>

**Conversion** 1 ppm = 2.58 mg/m<sup>3</sup>

**IDLH** 25 ppm  
See: [7697372](http://niosh/idlh/7697372.html) ([niosh/idlh/7697372.html](http://niosh/idlh/7697372.html))

### Exposure Limits

**NIOSH REL** : TWA 2 ppm (5 mg/m<sup>3</sup>)  
ST 4 ppm (10 mg/m<sup>3</sup>)  
**OSHA PEL** † ([nengapdxg.html](http://nengapdxg.html)) : TWA 2 ppm (5 mg/m<sup>3</sup>)

### Measurement Methods

**NIOSH 7903** ([niosh/docs/2003-154/pdfs/7903.pdf](http://niosh/docs/2003-154/pdfs/7903.pdf)) ;  
**OSHA ID165SG**  
(<http://www.osha.gov/dts/sltc/methods/inorganic/id165sg/id165sg.html>)  
(<http://www.cdc.gov/Other/disclaimer.html>)  
See: **NMAM** ([niosh/docs/2003-154/](http://niosh/docs/2003-154/)) or **OSHA Methods**  
(<http://www.osha.gov/dts/sltc/methods/index.html>)  
(<http://www.cdc.gov/Other/disclaimer.html>)

**Physical Description** Colorless, yellow, or red, fuming liquid with an acrid, suffocating odor. [Note: Often used in an aqueous solution. Fuming nitric acid is concentrated nitric acid that contains dissolved nitrogen dioxide.]

<b>MW:</b> 63.0	<b>BP:</b> 181° F	<b>FRZ:</b> - 44°F	<b>Sol:</b> Miscible	<b>VP:</b> 48 mmHg	<b>IP:</b> 11.95 eV
<b>Sp.Gr</b> (77° F): 1.50	<b>FLP:</b> NA	<b>UEL:</b> NA	<b>LEL:</b> NA		

**Noncombustible** Liquid, but increases the flammability of combustible materials.

**Incompatibilities & Reactivities** Combustible materials, metallic powders, hydrogen sulfide, carbides, alcohols [Note: Reacts with water to produce heat. Corrosive to metals.]

**Exposure Routes** inhalation, ingestion, skin and/or eye contact

**Symptoms** irritation eyes, skin, mucous membrane; delayed pulmonary edema, pneumonitis, bronchitis; dental erosion

**Target Organs** Eyes, skin, respiratory system, teeth

**Personal Protection/Sanitation** (See [protection codes \(protect.html\)](#))

**Skin:** Prevent skin contact

**Eyes:** Prevent eye contact

**Wash skin:** When contaminated

**Remove:** When wet or contaminated

**Change:** No recommendation

**Provide:** Eyewash (pH<2.5), Quick drench (pH<2.5)

**First Aid** (See [procedures \(firstaid.html\)](#))

**Eye:** Irrigate immediately

**Skin:** Water flush immediately

**Breathing:** Respiratory support

**Swallow:** Medical attention immediately

#### Respirator Recommendations

#### NIOSH/OSHA

##### Up to 25 ppm:

(APF = 25) Any supplied-air respirator operated in a continuous-flow mode\*

(APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern<sup>c</sup>

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern<sup>c</sup>

(APF = 50) Any self-contained breathing apparatus with a full facepiece

(APF = 50) Any supplied-air respirator with a full facepiece

##### Emergency or planned entry into unknown concentrations or IDLH conditions:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

##### Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern<sup>c</sup>

Any appropriate escape-type, self-contained breathing apparatus

[Important additional information about respirator selection \(pgintrod.html#mustread\)](#)

See also: [INTRODUCTION \(/niosh/npg/pgintrod.html\)](#) See ICSC CARD: [0183](#)

([/niosh/ipcsneng/nengo183.html](#)) See MEDICAL TESTS: [0158 \(/niosh/docs/2005-110/nmedo158.html\)](#)

Page last reviewed: April 4, 2011

Page last updated: November 18, 2010

Content source: [National Institute for Occupational Safety and Health \(NIOSH\)](#) Education and Information Division

Centers for Disease Control and Prevention 1600 Clifton Rd. Atlanta, GA 30333, USA  
800-CDC-INFO (800-232-4636) TTY: (888) 232-6348 - [Contact CDC-INFO](#)



## **ATTACHMENT B**

WESTON FLDs

## FLD 02 INCLEMENT WEATHER

Hot weather (ambient temperatures over 70°F), cold weather (ambient temperatures below 40°F), rain, snow, ice, and lightning are examples of inclement weather that may be hazardous or add risk to work activities. Extremes of heat, cold, and humidity, as well as rain, snow, and ice, can adversely affect monitoring instrument response and reliability, respiratory protection performance, and chemical protective clothing materials.

### RELATED FLDs AND OP

*FLD 05 – Heat Stress Prevention and Monitoring*

*FLD 06 – Cold Stress*

*OP 05-03-008 – Inclement Weather & Business Disruption Policy*

### PROCEDURE

The potential for exacerbating the impact of physical hazards must be considered for tasks that expose personnel to inclement weather. Risk assessment and hazards analysis should be accomplished during the planning stages of a project for the most likely inclement weather conditions that may be encountered, i.e., rain and lightning in late spring, summer, and early fall, or lightning prone areas; cold, snow, and ice in winter. The Field Safety Officer (FSO) must determine the proper safety procedures and recommend them to the site manager. Each worker must evaluate the risk associated with his/her work and be actively alert to these hazards. Managers and workers must be familiar with the requirements of FLD 05 and FLD 06.

A pre-site activity risk assessment must be completed when inclement weather occurs. Weather conditions that affect instruments and personal protective equipment (PPE) function must be conveyed to site workers who should monitor function and integrity of PPE and be alert to changing weather conditions. A decision must be made on the proper safety procedures to use if work must continue, or to stop work if the risk is too great. The appropriate Safety Professional **must be notified of all instances of the need to stop work for safety reasons, including inclement weather.**

### Heat

Hot, dry weather increases risk of soil drying, erosion, and dust dispersion, which may present or increase risk of exposure and environmental impact from toxic hazards. Hot weather will increase pressure on closed containers and the rate of volatilization, thereby potentially increasing the risk of exposure to toxic, flammable, or explosive atmospheres.

### Prevention and Protective Measures

Employees must be protected from airborne contaminants using engineering controls such as wetting dry soil to prevent particle dispersion, and providing local ventilation to reduce volatile air contaminants to safe levels, or if engineering controls are infeasible, using prescribed PPE. Wind shifts and velocity should be measured where change may result in dispersion of airborne contaminants into the work area.

### Rain, Wet Weather, and High Humidity

Wet conditions resulting from rain and wet weather increase slipping and tripping hazards, braking distances of vehicles, the potential for vehicle skidding, or difficulties in handling powered devices such as augers and drills. Rain fills holes, obscures trip and fall hazards, and increases risk of electrical shock

when working with electrical equipment. Changes in soil conditions caused by rain can impact trenching and excavating activities, creating the potential for quicksand formation, wall collapse, and cave-in. Vehicles become stuck in mud, and tools and personnel can slip on wet surfaces. Rain and wet conditions may decrease visibility (especially for personnel wearing respiratory protection) and limit the effectiveness of certain direct-reading instruments (e.g., photoionization detectors [PIDs]).

Feet that become wet and are allowed to remain wet can lead to serious problems under both heat and cold conditions. Activities that may result in wet feet include extended work in chemical protective clothing and wading in water/liquid during biological assessments. Trench foot, paddy foot, and immersion foot are terms associated with foot ailments resulting from feet being wet for long periods of time. All have similar symptoms and effects. Initial symptoms include edema (swelling), tingling, itching, and severe pain. These may be followed by more severe symptoms including blistering, death of skin tissue, and ulceration. (NOTE: The following Preventive and Protective Measures also apply to Cold, Snow, and Ice.)

### Preventive and Protective Measures

Walkways, stairs, ladders, elevated workplaces, and scaffold platforms must be kept free of mud, ice, and snow. Employees shall be prohibited from working on scaffolds covered with snow, ice, or other slippery material except as necessary for removal of such materials.

Vehicles used in rain or cold weather must have working windshield wipers and defrosters, and windows must be kept clear of obstruction.

Drivers must observe traffic laws, including maintaining speed within limits safe for weather conditions, and wearing seat belts at all times. Note that this may mean operating below the posted speed limit.

When walking, workers should use a walking stick or probe to test footing ahead where there is standing water, snow, or ice to protect the walker against stepping into potholes or onto puncture hazards, buried containers, or other potential structurally unsound surfaces.

Prior to using vehicles or equipment in off-road work, workers should walk the work area or intended travelway when puddles or snow may obscure potholes, puncture hazards, or buried containers, or other potential structurally unsound surfaces.

Project managers should arrange to have winches, come-alongs, or other mechanical assistance available when vehicles are used in areas where there is increased risk of getting stuck. Cable or rope and mechanical equipment used for pulling stuck vehicles must be designed for the purpose, of sufficient capacity for the load, and be inspected regularly and before use to ensure safety. **Manually pushing stuck vehicles is to be avoided.**

Prevention methods are required when work is performed in wet conditions or when conditions result in sweating, causing the feet to become and remain wet. Proper hygiene is critical. Workers must dry their feet and change socks regularly to avoid conditions associated with wet feet. Use of foot talc or powder can additionally assist in prevention of this type of condition.

### **Cold, Snow, and Ice**

Cold weather affects vehicle operation by increasing difficulty in starting and braking. Ice, frost, and snow can accumulate on windows and reduce vision. Cold, wet weather can cause icing of roadways,

driveways, parking areas, general work places, ladders, stairs, and platforms. Ice is not always as obvious to see as snow or rain, and requires special attention, especially when driving or walking.

Snow and ice increase the risk of accidents such as slipping when walking, climbing steps and ladders, or working at elevation, and the risk of accidents when driving vehicles or operating heavy equipment. Heavy snow and ice storms may cause electric lines to sag or break, and the use of electrical equipment in snow increases the risk of electric shock. Snow can hide potholes and mud, which can result in vehicles getting stuck or persons falling when stepping into hidden holes. Snow also may cover water, drums or other containers, sharp metal objects, debris, or other objects that can cause falls or punctures.

### Preventive and Protective Measures

WESTON personnel are cautioned against operating motor vehicles such as cars or trucks on ice under any circumstances. If traveling in icy conditions, WESTON personnel should follow all public service advisories that curtail driving activities.

Personnel performing activities that require working over ice should be aware of minimal ice thickness safety guidelines as follows:

- 4-inch minimum: activities such as walking or skating.
- 6-inch minimum: activities such as snowmobiling or the use of equipment with the same weight and cross-sectional area as a snowmobile.

Personnel should always be aware that these measurement guidelines are under ideal conditions and that snow cover, conditions on rivers, ponds, or lakes with active currents, and other environmental factors impact the safety of working on ice. Clear ice typically is the strongest, while ice that appears cloudy or honeycombed (contains entrained air) is not as structurally strong. Measurements made by drilling or cutting through the ice should be made every few feet to verify safe conditions. Provisions for rescue (e.g., ladders or long poles and effective communications) must be available at the work site.

### **Lightning**

Lightning represents a hazard of electrical shock that is increased when working in flat open spaces, elevated work places, or near tall structures or equipment such as stacks, radio towers, and drill rigs. Lightning has caused chemical storage tank fires and grass or forest fires. Static charges associated with nearby electrical storms can increase risk of fire or explosion when working around flammable materials, and can adversely affect monitoring instruments.

Lightning is the most dangerous and frequently encountered weather hazard people experience each year. Lightning affects all regions. **Florida, Michigan, Pennsylvania, North Carolina, New York, Ohio, Texas, Tennessee, Georgia, and Colorado** have the most lightning deaths and injuries.

### Preventive and Protective Measures

Prior to working in areas or beginning projects when or where there is an increased potential for lightning striking personnel, steps must be taken to predict the occurrence of lightning strikes. Recommendations include:

- Check with client management to determine if there are any patterns or noted conditions that can help predict lightning or if there are structures that are prone to lightning strikes. Arrange for

client notification when there is increased potential for lightning activities. Ensure that clients include WESTON workers in lightning contingency plans.

- Monitor weather reports.
- Note weather changes and conditions that produce lightning.
- Stop work in open areas, around drill rigs or other structures that may attract lightning, on or in water and in elevated work places when lightning strikes are sighted or thunder is heard near a work site.
- Ensure all personnel are provided with safe areas of refuge. Prevent personnel from standing in open areas, under lone trees, or under drill rigs.
- Observe the “30-30” Rule. If you see lightning and thunder is heard within 30 seconds (approximately 6 miles), seek shelter. If you hear thunder, but did not see the lightning, you can assume that lightning is within 6 miles and you should seek shelter. Remain in the sheltered location for 30 minutes following the last lightning strike.
- Use a hand held static potential meter (lightning detection device) to monitor the potential difference between a cloud and the ground. When the measured potential is greater than 2 kV/m, there is a potential for a lightning strike – seek shelter.

## **High Wind and Tornado Safety**

### High Winds

Many construction workers have died due to wind-related accidents and injuries. A ladder that seems secure under normal circumstances can become unstable during windy conditions and cause you to fall. Scaffolding that is improperly secured can rip free during strong winds and kill bystanders. The risk of injury for construction workers increases during strong winds. Keep in mind that changing weather conditions can affect your daily work tasks, and make sure you have a game plan to prevent proper damage and personal injury.

Stay Informed: With today’s modern technology available at the touch of a button, you should keep up to date with the latest local weather reports. Visit [weatherbug.com](http://weatherbug.com) or [weather.gov](http://weather.gov) to stay informed in case of wind warnings, watches, and advisories. Larger projects may have their own weather station on site to provide instant weather data. Use daily hazard assessments to determine if working conditions have changed or will change throughout the day.

Be Prepared: When you know the weather will be windy, secure loose building materials, scaffolding and fencing that could be picked up or torn loose by strong winds and thrown onto surrounding streets, structures, vehicles, or bystanders.

Know the Limits of Your Equipment: When operating any equipment, take time to read the operator’s manual and become familiar with the wind specifications. Many crane manufacturers have high-wind guidelines to prevent you from operating a crane in unsafe weather. You should also check safety equipment such as fall protection to determine if it is adequate for windy conditions.



## Know the Terminology

### Severe Thunderstorm Watch

A Severe Thunderstorm Watch means that strong thunderstorms capable of producing winds of 58 mph or higher and/or hail 3/4 inches in diameter or larger are possible. If you are in the area of a Severe Thunderstorm Watch, you should be prepared to take shelter from thunderstorms. Severe Thunderstorm Watches are generally issued for 6-hour periods.

### Severe Thunderstorm Warning

A Severe Thunderstorm Warning means that thunderstorms capable of strong winds and/or large hail are occurring or could form at any time. If you are in the area of a severe thunderstorm, you should take shelter indoors immediately, avoid windows, and be prepared for high winds and hail. Severe Thunderstorm Warnings are generally in effect for an hour or less.

### High Wind Watch

A High Wind Watch is issued when sustained winds exceeding 40 mph and/or frequent gusts over 60 mph are likely to develop in the next 24 to 48 hours. For summit areas, high wind watches are issued when sustained winds are expected to exceed 45 mph and/or frequently gust over 60 mph. If you are in an area for which a High Wind Watch has been issued you should secure loose objects outdoors that may blow about and avoid outdoor activity that exposes you to high winds.

### High Wind Warning

A High Wind Warning is issued when sustained winds exceeding 40 mph and/or frequent gusts over 60 mph are occurring or imminent. For summit areas, warnings are issued for winds exceeding 45 mph and/or frequently gusting over 60 mph. Wind warnings may issued up to 24 hours ahead of the onset of high winds and remain in effect for 6 to 12 hours. If you are in an area where a high wind warning is in effect you should avoid activities that expose you to high winds. Loose objects may be blown around. Tree limbs may break and fall. Power lines may be blown down.

### Wind Advisory

A Wind Advisory is issued when sustained winds of 30 to 39 mph and/or frequent gusts to 50 mph or greater are occurring or imminent. Wind advisories may be in effect for 6 to 12 hours. If you are in an area where a wind advisory is in effect you should secure loose objects that may be blown about outdoors and limit activity that may expose you to high winds.

Work Safely: If you will be working on a windy day, you should be alert and protected. Wear eye protection to prevent dust and other particles from entering or striking your eyes. Keep your hard hat on at all times to prevent injuries from falling or flying objects. The likelihood of falls from heights is greatly increased by strong winds. Wear the necessary PPE to ensure your safety.

To avoid flying debris and to minimize damage during high winds:

- Shut down outdoor activities involving work at elevation on ladders, scaffolding, aerial lifts, etc.; handling large tarps and plastic sheeting when wind speeds exceed 25 mph; including work with radioactive materials and highly toxic materials that could be dispersed by the winds.
- At 13 - 18 mph wind will raise dust. Follow the dust action level.

- Move mobile items stored outside to indoor storage.
- Secure any items that cannot be moved inside.
- Be careful opening exterior doors.
- Be cautious about downed power lines, tree limbs, and debris on roads.
- Be alert for animals who have escaped from farms and zoos.

Stay Away from Power Lines: High winds can cause tree limbs to fall on power lines resulting in electrocution hazards or loss of power. Your best bet is to keep your distance.

## Tornados

### What is a TORNADO?

A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud. It is spawned by a thunderstorm or as a result of severe weather associated with hurricanes. A funnel cloud is formed as cool air overrides a layer of warm air, forcing the warm air to rise rapidly. The damage from a tornado results from high wind velocity and wind blown debris.

### Tornado Safety

When a tornado approaches, you have only a brief amount of time to make life-or-death decisions. Advance planning and quick response are the keys to surviving a tornado.

Purchase a NOAA Weather Alert radio with an alert feature. When tuned to the proper frequency, these weather radios remain silent until a weather emergency occurs. Once they pick up the alarm tone, they will begin broadcasting emergency weather information so that citizens can protect themselves and their property. Some models of the NOAA weather radio incorporate the Specific Area Message Encoder technology, allowing users to target only those warnings that affect their immediate geographic area.

Conduct tornado drills. Designate an area to serve as your safe area, and practice having team members assemble there in response to a mock tornado warning.

Emergency Communications Plan. Develop an emergency communications plan in case team members are separated from one another when a tornado warning goes into effect. Designate an emergency coordinator. Instruct everyone to contact this coordinator in a weather emergency for instructions on what to do during the storm and where to reassemble after the emergency has passed. Design contingency plans to be consistent with client contingency plans. When possible use client warning and alerting systems and confirm that team members have access to shelters and know how to get to them.

### Know the Difference between a Tornado Watch and a Tornado Warning

Tornado Watch: Issued by the National Weather Service when tornadoes are possible in your area. You should remain alert for approaching storms. Remind family members of where the safe areas are within your home, and carefully monitor radio or television reports for further developments.

Tornado Warning: Indicates that a tornado has been sighted in your area, or is indicated on weather radar. You should proceed to safe shelter immediately.

*When A Tornado Warning Goes In Effect, Put Your Safety Plans In Action.*

**In Your Automobile:** Motor vehicles are easily overturned by tornado winds. Leave your vehicle and seek shelter in a sturdy building. As a last resort, seek shelter in a ditch or culvert. Do not try to outrun or outmaneuver a tornado! Use the time to seek appropriate shelter outside your vehicle.

**Office Buildings, Hotels, and Shopping Centers:** Take shelter in an interior hallway on a lower floor. A closet, bathroom or other small room with short, stout walls will give some protection from collapse and flying debris. Otherwise, get under heavy furniture and stay away from windows. Many tornado deaths have occurred in large buildings due to the collapse of a roof or wide span wall. A corner area, away from a window, is safer than the middle of a wide span wall.

**Out In Open Country:** When severe weather approaches, seek inside shelter immediately. The chances of encountering falling trees, downed power lines and lightning are far greater than encountering a tornado itself. If a tornado approaches, lie flat in the nearest depression, such as a culvert or ditch, and cover your head with your arms.

**BE ALERT TO CHANGING WEATHER CONDITIONS**

**HAVE AN EMERGENCY WEATHER PLAN IN PLACE**

**REHEARSE YOUR CONTINGENCY PLANS PERIODICALLY**

**KNOW WHERE TO GO WHEN A TORNADO THREATENS.**

## **FLD 05 HEAT STRESS PREVENTION AND MONITORING**

Heat stress may occur at any time work is performed at elevated temperatures. If the body's physiological processes fail to maintain a normal body temperature because of excessive heat, a number of physical reactions can occur such as fatigue, irritability, anxiety, and decreased concentration or dexterity, and possibly death. Because heat stress is one of the most common and potentially serious illnesses at field sites, regular monitoring and other preventive measures are vital to ensure worker safety. Wearing chemical protective clothing often decreases natural body heat loss (cooling) and increases the risk of heat stress.

Employees who are taking prescription or over-the-counter medications should consult with their personal physician prior to working in high-temperature environments to see if their medication would impair their ability to handle heat stress.

### **REFERENCES**

OSHA 29 CFR 1910 and 1926

### **RELATED FLDs**

*FLD 02 – Inclement Weather*

*FLD 03 – Hot Processes – Steam, Low Temperature Thermal Treatment Unit, and Transportable Incinerator*

*FLD 08 – Confined Space Entry Program*

*FLD 36 – Welding/Cutting/Brazing/Radiography*

*FLD 37 – Pressure Washers/Sandblasting*

### **PROCEDURE**

#### **Heat Stress Symptoms and Treatment**

##### Heat Rash

Heat rash, also known as prickly heat, may occur in hot and humid environments where sweat is not easily removed from the surface of the skin by evaporation and is aggravated by chafing clothes. When extensive or complicated by infection, heat rash can be so uncomfortable that it inhibits sleep and impairs a worker's performance.

Symptoms – Mild red rash, especially in areas of the body that come into contact with protective gear.

Treatment – Decrease amount of time spent working in protective gear and provide body powder to help absorb moisture and decrease chafing. Heat rash can be prevented by showering, resting in a cool place, and allowing the skin to dry.

##### Heat Cramps

Heat cramps are caused by inadequate electrolyte intake. The individual may be receiving adequate water; however, if not combined with an adequate supply of electrolytes, the blood can thin to the point where it seeps into the active muscle tissue, causing cramping.

Symptoms – Acute painful spasms of voluntary muscles, most notably the abdomen and extremities.

*Treatment* – Move the victim to a cool area and loosen clothing. Have the victim drink 1 to 2 cups of cool potable water or diluted commercial electrolyte solution (e.g., Gatorade, Quench) immediately, and then every 20 minutes thereafter until symptoms subside. Electrolyte supplements can enhance recovery; however, it is best to double the amount of water required by the dry mix package directions or add water to the liquid form.

### Heat Exhaustion

Heat exhaustion is a state of weakness or exhaustion caused by the loss of fluids from the body. Heat exhaustion is not as dangerous as heat stroke, but if not properly managed in the field it may lead to heat stroke.

*Symptoms* – Pale, clammy, and moist skin, profuse perspiring, and extreme weakness. Body temperature is normal, pulse is weak and rapid, and breathing is shallow. The person may have a headache, may vomit, may feel dizzy, and may be irritable or confused.

*Treatment* – Move the victim to a cool, air-conditioned or temperature-controlled area, loosen clothing, place in a position with the head lower than the feet (shock prevention), and allow the victim to rest. Consult a physician. Ensure that the victim is not nauseated or vomiting. If not nauseated or vomiting, give the victim small sips of cool water or diluted electrolyte replenishment solution (one to one dilution with water, or if mixing from powder, double the water added). If this is tolerated, have the victim drink 1 to 2 cups of fluid immediately, and every 20 minutes thereafter until symptoms subside. Seek medical attention at the advice of the consulting physician.

### Heat Stroke

Heat stroke is an acute and dangerous reaction to heat stress caused by a failure of the body's heat regulating mechanisms, i.e., the individual's temperature control system (sweating) stops working correctly. Body temperature rises so high that brain damage and death may result if the person is not cooled quickly.

*Symptoms* – Red, hot, dry skin (although the person may have been sweating earlier); nausea, dizziness, confusion, extremely high body temperature (i.e., 104°F or greater as measured with an oral thermometer), rapid respiratory and pulse rate, seizures or convulsions, unconsciousness or coma.

*Treatment* – Immediately call for emergency medical assistance. Remove the victim from the source of heat and cool the victim quickly. If the body temperature is not brought down quickly, permanent brain damage or death may result. Remove all PPE and as much personal clothing as decency permits. Fan the person while sponging or spraying with cool or tepid water. Apply ice packs (if available) to the back of the neck, armpits, groin area, or behind the knees. Place the victim flat on their back or with head and shoulders slightly elevated. If conscious, and not nauseated or vomiting, the victim may be provided sips of cool water. Do not give the victim coffee, tea, or alcoholic beverages. Emergency medical personnel will take over treatment when they arrive.

## **Recognition and Risk Assessment**

In the planning stages of a project, the potential for heat stress disorders must be considered as a physical hazard in the site-specific Health and Safety Plan (HASP). Risk assessment can be accomplished in the development stages of a project by listing in the HASP the most likely heat stress disorders that may occur. The Field Safety Officer (FSO) must make decisions on the proper safety procedures and recommend them to the site manager. Each worker must evaluate the risk associated with his or her work and be actively alert to these hazards. Any site worker may stop work if safety procedures are not

followed or the risk is too great. In addition, all site personnel must be aware of these symptoms in both themselves and their co-workers.

### **Prevention and Protection Programs**

Heat stress is affected by several interacting factors including, but not limited to, age, obesity, physical condition, substance abuse, level of personal protective equipment (PPE) worn, and environmental conditions (temperature, shade, and humidity). Site workers must learn to recognize and treat the various forms of heat stress. The following recommendations should be followed to prevent heat stress:

- The most important measure to prevent heat-related illness is adequate fluid intake. Workers should drink 1/2 to 1 quarts of liquids per hour in high heat conditions. Most of this liquid should be water. Under heavy work and heat conditions, the body may lose up to 2 gallons of fluids per day. To prevent heat stress symptoms, the individual must ensure replacement of this fluid.
- Provide disposable cups that hold about 4 ounces, and water that is maintained at 50 to 60°F. Workers should drink 16 ounces of water before beginning work, and a cup or two at each break period.
- Provide a shaded area for rest breaks. Ensure that adequate shelter is available to protect personnel against heat and direct sunlight. When possible, shade the work area.
- Discourage the intake of caffeinated drinks during working hours.
- Monitor for signs of heat stress.
- Encourage workers to maintain a good diet during these periods. In most cases, a balanced diet and lightly salted foods should help maintain the body's electrolyte balance. Bananas are especially good for maintaining the body's potassium level.
- If utilizing commercial electrolyte mixes, double the amount of water called for in the package directions. Indications are that "full-strength" preparations taken under high heat stress conditions may actually decrease the body's electrolytes.
- Acclimate workers to site work conditions by slowly increasing workloads (i.e., do not begin work activities with extremely demanding tasks).
- Rotate shifts of workers who are required to wear impervious clothing in hot weather.
- Encourage workers to wear lightweight, light-colored, loose-fitting clothing.
- In extremely hot weather, conduct field activities in the early morning and evening.
- Provide cooling devices to aid natural body heat regulation. These devices, however, add weight and their use should be balanced against worker efficiency. An example of a cooling aid is long cotton underwear, which acts as a wick to absorb moisture and protect the skin from direct contact with heat-absorbing protective clothing.
- Good hygienic standards must be maintained by frequent showering and changes of clothing.
- Clothing should be permitted to dry during rest periods.
- Whenever working in the sun, provide employees with sunscreen with both UVA and UVB protection.
- Persons who notice skin problems should immediately consult medical personnel.

## Heat Stress Monitoring and Work Cycle Management

When strenuous field activities are part of on-going site work conducted in hot weather, the following guidelines should be used to monitor the body's physiological response to heat, and to manage the work cycle, even if workers are not wearing impervious clothing. These procedures should be instituted when the temperature exceeds 70°F and the tasks/risk analysis indicates an increased risk of heat stress problems. Consult the HASP and a safety professional (e.g., Division EHS Manager, FSO) if questions arise as to the need for specific heat stress monitoring. In all cases, the site personnel must be aware of the signs and symptoms of heat stress and provide adequate rest breaks and proper aid as necessary.

Measure Heart Rate – Heart rate should be measured by the radial pulse for 30 seconds as early as possible in the rest period. The heart rate at the beginning of the rest period should not exceed 110 beats per minute. If the heart rate is higher, the next work period should be shortened by 33%, while the length of the rest period stays the same. If the pulse rate still exceeds 110 beats per minute at the beginning of the next rest period, the following work cycle should be further shortened by 33%. The procedure is continued until the rate is maintained below 110 beats per minute.

Measure Body Temperature – When ambient temperatures are over 90°F, body temperatures should be measured with a clinical thermometer as early as possible in the rest period. If the oral temperature exceeds 99.6°F (or 1 degree change from baseline) at the beginning of the rest period, the following work cycle should be shortened by 33%. The procedure is continued until the body temperature is maintained below 99.6°F (or 1 degree change from baseline). Under no circumstances should a worker be allowed to work if their oral temperature exceeds 100.6°F.

Measure Body Water Loss – Body water loss greater than 1.5% of total body weight is indicative of a heat stress condition. Body weight is measured before PPE is donned and after the PPE is removed following a work cycle. Body water loss can be measured with an ordinary bathroom scale; however, the scale must be sensitive to one-half pounds increments. A worker is required to drink additional fluids and rest if their body water loss is greater than 1.5%.

**NOTE:** For purposes of this operating practice, a break is defined as a 15-minute period and/or until an individual's vital signs are within prescribed guidelines.

A physiological monitoring schedule is determined by following the steps below:

- Measure the air temperature with a standard thermometer.
- Estimate the fraction of sunshine by judging what percent the sun is out (refer to Table 1).
- Calculate the adjusted temperature based on the following formula:  
$$\text{Adjusted Temperature} = \text{Actual Temperature} + 13 \times X \text{ (where } X = \text{sunshine fraction from Table 1)}$$
- Using Table 2, determine the physiological monitoring schedule for fit and acclimated workers for the calculated adjusted temperature.

The length of work period is governed by frequency of physiological monitoring (Table 2). The length of the rest period is governed by physiological parameters (heart rate and oral temperature).

**Table 1. Percent Sunshine Factors  
Heat Stress Prevention and Monitoring**

<b>Percent Sunshine (%)</b>	<b>Cloud Cover</b>	<b>Sunshine fraction</b>
100	No cloud cover	1.0
50	50% cloud cover	0.5
0	Full cloud cover	0.0

**Table 2. Physiological Monitoring Schedule  
Heat Stress Prevention and Monitoring**

<b>Adjusted Temperature</b>	<b>Level D (Permeable clothing)</b>	<b>Level C, B, or A (Nonpermeable clothing)</b>
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°F (30.8° - 32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5° - 87.5°F (28.1° - 32.2°C)	After each 90 minutes of work	After each 60 minutes of work
77.5° - 82.5°F (25.3° - 28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5° - 77.5°F (22.5° - 25.3°C)	After each 150 minutes of work	After each 120 minutes of work

**Example:** Site personnel anticipate wearing level C (impermeable clothing) during site activities. The air temperature is 80°F and there are no clouds in the sky (100% sunshine). The adjusted temperature is calculated in the following manner:

$$\begin{aligned}\text{Adjusted Temperature (Adj T } ^\circ\text{F)} &= \text{Actual Temperature (Amb T } ^\circ\text{F)} + (13 \times \text{sunshine fraction}) \\ \text{Adj T } ^\circ\text{F} &= 80^\circ\text{F} + (13 \times 1.0) \\ \text{Adj T } ^\circ\text{F} &= 93^\circ\text{F}\end{aligned}$$

Using Table 2, the pulse rate, oral temperature and body water loss monitoring would be conducted after each 15 minutes of work. The adjusted temperature may need to be redetermined if the percent sunshine and ambient temperature changes drastically during site work.

If an individual's heart rate exceeds 110 beats per minute at the beginning of the rest period, that individual will continue to rest until his or her heart rate drops to baseline; the next work period is then decreased by 33%.



## FLD 10 MANUAL LIFTING AND HANDLING OF HEAVY OBJECTS

Improper lifting can result in cuts, pinches, crushing, and serious injury to back, abdomen, arm and leg muscles, and joints. Even relatively light objects, lifted improperly, can contribute to injury. Muscle and joint injuries occur when objects to be lifted are too heavy or awkward, are lifted improperly, or in areas where access is restricted. Lifting tasks which are awkward and repetitive, even if involving only light objects, can lead to nerve and joint damage.

At the project level, the need for manual lifting or handling of heavy objects must be identified as a physical hazard in the planning stages of a project Health and Safety Plan (HASP).

### MANUAL LIFTING

Plan any manual lifting task noting the following:

**Contact hazards.** Check each object before lifting for presence of splinters, splinters, sharp edges or parts, cracks and loose joints, which can result in cuts. Signs of biological hazards, and chemical or radioactive material contamination.

- **Weight of object.** Unless involved in weight training, recommended safe lifting weights for an average man or woman are 50 and 35 pounds, respectively.
- **Size and shape of object.** Large and oddly shaped objects are more difficult to lift, even within safe weight limits, due to imbalanced center of gravity.
- **Area in which lifting is to be done.** Heavy objects can pinch or crush fingers, toes, arms, and legs between the object and nearby objects (e.g., walls, tables, counters, or railings). Check for pinch points such as other objects close by and ensure there is room for safe lifting.
- **Conditions under which lifting is to be accomplished.** Check for wet or slippery surfaces. Consider level of protection to be used. Level B or A protection may add up to 40 lbs. To be lifted, as well as restricting range of motion and adding to area restriction by increasing bulk.

**Route to be traveled, if lifting includes carrying.** Check walking and working surfaces for slip and trip hazards, note ramps, changes in level of elevation, and ladders or stairways that need to be negotiated.

### Manual Lifting - Prevention and Protection

- Before lifting, identify the potential for contact hazards on objects to be lifted. Check each object before lifting, remove any noted hazards as feasible, and wear gloves (cotton, at a minimum, or leather, kevlar, or chemical resistant material, depending on the nature of the hazard).
- Avoid contact with, or cover cracks or loose joints to reduce hazards of pinching.
- Workers must know their lifting limitations, plan before lifting, keep themselves in good physical condition, and get help if uncertain that they can lift safely. Managers must plan and allow for safe lifting.
- When lifting an object from the floor:
  - Determine that the object is within the safe weight limit.
  - Check for contact hazards.
  - Walk the intended route of travel to identify and remove slip and fall hazards.
  - Identify changes in elevation, steps, ramps, stairs and ladders that must be negotiated.

- To lift square or rectangular objects:
  - Avoid reaching as you lift.
  - Set feet firmly, placing one foot alongside the load and the other slightly behind the load.
  - Keep objects close to the body.
  - Squat in front of the load.
  - Grasp one of the top corners away from the body and the opposite bottom corner closest to the body.
  - Tilt the object slightly away from the body, tilt forward at the hips, keep the back straight and tuck in the chin.
  - Straighten the legs, keeping the spine straight, pull the object into the body and stand up slowly and evenly without jerking or twisting.

If turning or change of direction is required, turn with feet without twisting the torso and step in the direction of travel

To set an object down, reverse the sequence, being sure not to trap the bottom hand between the object and the surface on which the object is set.

Workers must be trained and have the opportunity to use the above steps with lighter objects before performing heavy lifting. **For odd-shaped objects, the only modification needed should be hand-hold position.** When two or more persons are lifting, have a plan and a set of signals so lifting occurs simultaneously.

Do not carry objects in a manner which obstructs vision in the line of travel.

Carry objects so one hand is free to hold the handrail on stairs and that there is an unobstructed view of footing. Carry objects in a manner to permit use of both hands while climbing a ladder.

## MANUAL HANDLING OF HEAVY OBJECTS

Manual handling of heavy objects, even when not lifting, can pose the same hazards as lifting including cuts, pinches, bruises, crushing, muscle and joint strain, and contact with hazardous materials and biological hazards.

Drums and other containers which must be maneuvered for access to information or sampling locations, that are inaccessible to mechanical handling equipment, require manual handling and special precautions. When handling of heavy objects does not involve lifting, workers can handle heavier objects safely, even those weighing several hundred pounds, if proper techniques are used. In many instances, the procedures involve balancing and taking advantage of the shape of the object.

### Manual Handling - Prevention and Protection

Prior to performing manual handling, it must be determined that it can be done safely and that mechanical assistance is infeasible. Mechanical equipment or assistance such as dollies, carts, come-alongs or rollers are to be used whenever possible. Mechanical assistance must be of proper size, have wheels sized for the terrain, and be designed to prevent pinching or undue stress on wrists. Objects to be moved must be secured to prevent falling and properly balanced to prevent tipping.

The minimum protection for manual handling is heavy cotton or leather gloves, safety boots, and coveralls. Metatarsal guards, chemical protective clothing, and metal mesh or kevlar gloves must be used as risk increases of heavy items falling, hazardous materials contact and sharp edges, splinters or slivers.

Workers must be aware of and work within their weight-handling capabilities.

Objects to be manually handled must be checked for contact hazards before handling, and to ensure handling will not trap hands, arms, legs, or feet between the object and other objects, walls, or railings.

Properly trained personnel may roll heavy objects with a round base such as 55-gallon drums or compressed gas cylinders, if rolling will not damage the structural integrity. Rolling must be controlled by chutes, tag-lines, or other means of limiting acceleration. Use of the legs for pushing and tag-line control of rolled objects must be stressed.

Only properly trained personnel may move cylindrical objects which must remain upright by hand. Cylindrical objects, such as drums that must remain upright, are handled manually by slightly tilting the object, using the legs for control, and balancing the object on the bottom edge. The handler then walks beside the object, with the object tilted toward the body, positioning the hands on the top edge away from the body and moving so they do not cross, thus maintaining balance and a steady controlled forward motion.

Prior to moving cylindrical objects in this way, the route of travel must be walked to identify any changes of elevation, pot holes, or other obstructions that could cause the object to snag, tip, or get out of control.

Flat, square, or rectangular objects are most easily handled using make-shift rollers or skids to break the friction with the resting surface and pushing, using the legs.

## **FLD 11 ROUGH TERRAIN/ATV USE**

### **RELATED FLDs**

*FLD 02 – Inclement Weather*

*FLD 05 – Heat Stress Prevention and Monitoring*

*FLD 06 – Cold Stress*

*FLD 22 – Heavy Equipment Operation*

*FLD 47 – Clearing, Grubbing, and Logging Operations*

*FLD 57 – Motor Vehicle Safety*

### **HAZARD**

Physical hazards associated with rough terrain include vehicle accidents, heavy equipment incidents, falling, slipping, and tripping.

Driving vehicles on uneven surfaces creates a possibility of the vehicle rolling, getting stuck in mud or ditches, or of an accident due to flat tires or striking obstacles and other vehicles.

When working on foot, steep inclines and heavy or downed vegetation can hide holes or breaks in the terrain, increasing the risk of slips, trips, and falls.

### **RECOGNITION AND RISK ASSESSMENT**

Rough terrain complicates work activities and adds to or increases risk. In the planning stages of a project, rough terrain must be considered as a physical hazard and identified in the site-specific health and safety plan (HASP). Risk assessment is usually accomplished from site history information (i.e., site topography) and on site by the Field Safety Officer (FSO).

### **HAZARD PREVENTION AND PROTECTION PROGRAMS**

#### **Safety on Foot**

Personnel working on rough terrain should maintain a high level of physical conditioning due to increased body stress and exertion.

The site crew should be alert and observe terrain while walking to minimize slips, trips, and falls.

Boots should be ankle high or higher to provide additional support and stability.

Work will be completed in adequate natural light or sufficient illumination will be maintained.

Site personnel will conduct an initial walkover and the “buddy system” will be implemented.

Emergency communications such as a cell phone or two-way radio should be carried at all times.

Personnel should be aware of potential hazards and ensure the availability of first-aid supplies and knowledge of the location of the nearest medical assistance.

#### **VEHICLE SAFETY**

Vehicle drivers and passengers will wear seatbelts at all times.

Hazards can be prevented by ensuring regular maintenance is performed on vehicles and all safety features are working. Have brakes and wheel bearings of vehicles used off road or in four wheel drive inspected at increased frequency (suggest inspections at twice the manufacturer's recommended frequency).

In order to minimize accidents, site surveillance on foot may be required to ensure clear driving paths.

Minimize side hill travel. Travel straight up and down hills whenever possible. Passengers will not be allowed when side hill travel is required.

Take into account loads or superstructure of vehicles which raise the center of gravity and increase risk of tipping.

Cross streams, small logs or other passable (there is adequate clearance of the undercarriage) obstructions at right angles.

Four wheel drive vehicles should be used if terrain conditions are wet, frozen, broken, or otherwise deemed unsafe for two wheel drive vehicles by the FSO. Use of vehicles off-road will be specifically addressed in the HASP and personnel operating vehicles will be checked for proficiency.

- Before moving a vehicle in the field, first walk the route of travel, inspecting for depressions, stumps, gullies, ruts, and similar obstacles.
- Always check the brakes of a vehicle before traveling, particularly on rough, uneven, or hilly ground.
- Check the complete drive train of a carrier at least weekly for loose or damaged bolts, nuts, studs, shafts, and mountings.
- Engage the all wheel drive when traveling off highway on hilly terrain.
- Increase tire pressures before traveling in hilly terrain (do not exceed rated tire pressure).
- Use the assistance of someone on the ground as a guide when lateral or overhead clearance is close.
- After the vehicle/equipment has been moved to a new site, set all brakes and/or locks. When grades are steep, block the wheels.

## **Definitions**

**Class I, All-terrain vehicle (ATV):** A motorized off-highway vehicle, 50 in. (127 cm) or less in width, having dry weight of 800 lbs (362.9 kg) or less, and traveling on three or more low pressure tires (10 lbs [4.5 kg] psi or less), with a seat designed to be straddled by the operator.

**Class I, Category G, ATV:** An ATV intended for general recreational and utility use.

**Class I, Category U, ATV:** An ATV intended primarily for utility use.

**Class II, ATV:** A motorized off-highway vehicle with a width which exceeds 50 in. (127 cm) or having a dry weight that exceeds 800 lbs (362.9 kg), traveling on four or more low-profile, low-pressure tires (10 lbs [4.5 kg] psi or less) and having a bench seat.

**NOTE:** Utility Vehicles are designed to perform off-road utility tasks such as passenger and cargo transportation and are addressed separately below. Examples are Rangers, Rhino, M-Gators, Gators, and Mules.

Rollover Protective Structure (ROPS). A cab or frame that provides a safe environment for the tractor operator in the event of a rollover.

## **ALL TERRAIN VEHICLES (ATVS)**

### **Qualifications**

ATV operators will have completed a nationally recognized accredited ATV training course (such as provided by the Specialty Vehicles Institute of America or in-house resources that have been certified as trainers by an accredited organization) prior to operation of the vehicle.

The operator must pass an operating skills test prior to being allowed to operate an ATV. Proof of completion of this training will be maintained.

### **Equipment**

All ATVs shall be equipped with:

- An operable audible warning device (horn);
- Headlights (if it will be used during hours of darkness);
- Taillights; and
- Brake lights.
- Mufflers and spark arresters.

All Class II ATVs will be equipped with ROPS and seatbelts

### **Operation**

Only Class I and Class II ATVs with four or more wheels may be used. Class III ATV's may not be used.

The manufacturer's recommended payload will not be exceeded at any time.

Gloves and an approved motorcycle helmet with full-face shield or goggles will be worn at all times while operating a Class I ATV.

An ATV will not be driven on public roadways except to cross the roadway, and it will only be driven on a public roadway at designated crossing points or with a road guard (no paved road use unless allowed by the manufacturer).

A copy of the operator's manual will be kept on the vehicle and protected from the elements (if practicable).

Tires shall be inflated to the pressures recommended by the manufacturer.

Passengers are prohibited on Class I ATVs.

## UTILITY VEHICLES

Utility vehicles are defined as specialty Class II ATVs designed to perform off-road utility tasks such as passenger and cargo transportation. Examples are Rangers, Rhino, M-Gators, Gators, and Mules.

Utility vehicle operators shall be trained and familiar with the use of all controls; understand proper moving, stopping, turning and other operating characteristics of the vehicle. Operators must review all training materials provided by the manufacturer for the specific vehicles, and training should be in accordance with appropriate manufacturer recommendations. A copy of the operator's manual shall be kept on the vehicle at all times and protected from the elements. At a minimum, training should address:

- Basic riding tips from the manufacturer's published literature for each vehicle.
- Reading terrain.
- Climbing hilly terrain.
- Descending a hill.
- Traversing a slope.
- Riding through water.
- Cargo carriers and accessories.
- Loading and unloading.
- Troubleshooting.
- Proper preventative maintenance, (i.e., oil levels, tire pressure requirements and scheduled maintenance requirements according to the manufacturer's guidelines.).

Utility vehicles shall be equipped with:

- Operable audible warning device (horn).
- Headlights.
- Taillights.
- Brake lights.
- Seatbelts.
- ROPS.

Occupancy in utility vehicles is limited to manufacturer designated seating that has built-in seatbelts. Passengers may not ride in the vehicle's back cargo area unless the vehicle is otherwise equipped. Note: When used for emergency response, medical litters may be placed in the back cargo area but must be secured as described below.

The manufacturer's recommended load carrying capacity, personnel capacity, or maximum safe vehicle speed shall not be exceeded at any time.

Cargo items will be secured as necessary to prevent movement/tipping. All loads over fifty pounds (to include medical litters) must be securely strapped to cargo tie-downs in the rear and to the cargo shelf in the front.

Seatbelts will be worn by operators and passengers of specialty vehicles where installed by the manufacturer. Operators and passengers shall wear goggles at all times when a utility vehicle, not equipped with a windshield, is in motion.

Utility vehicles will not normally be driven on public roadways except to cross the roadway, and will only be driven on a public roadway at designated crossing points or with a road guard. Utility vehicles that are allowed to operate outside a controlled work area and/or on public roads will meet the minimum vehicle safety standards in accordance with 49 CFR 571.5, to include ROPs, seatbelts and placement of “Slow Moving Vehicle” emblems where required.

Manufacturer-installed safety equipment will be maintained in working order and used in compliance with the requirement of this regulation and in accordance with manufacturer’s recommendations.

## **RULES**

Observe the following practices to help prevent accidents:

- Do not misuse utility vehicles.
- Reduce speed and exercise extreme caution on slopes or on rough ground.
- Do not overload vehicle and avoid shifting loads. Reduce load when operating over rough or hilly terrain.
- Do not stop or start suddenly when going uphill or downhill. Be especially cautious when changing direction on slopes.
- Stay alert for holes, rocks, and other hidden hazards in the terrain.
- Keep away from drop-offs, ditches, embankments, as well as ponds and other bodies of water. The machine could suddenly turn over if a wheel is over the edge of a cliff or ditch, or if an edge caves in.
- Keep front wheels straight at crest of hill or going over bumps.
- When descending a hill, remove foot from accelerator and apply brakes to reduce speed and maintain control.

## **Transport Loads Safely**

- Be sure load is evenly distributed.
- Do not load above the load guard.
- Securely anchor all loads in cargo box.
- Reduce cargo box capacity when operating on rough or hilly terrain.
- Use existing trails. Avoid terrain such as dangerous slopes and impassable swamps. Watch carefully for sharp bumps, holes, ruts, or obstacles.
- Look ahead at terrain. Know what is coming and be prepared to react. Be alert for hazards.
- Keep front wheels straight at the crest of a hill or going over bumps.
- Reduce speed according to trail, terrain, and visibility conditions.
- The passenger should always use the hand holds.



### **Climbing or Descending a Hill**

- Always use the brakes when going down slopes, the utility vehicle can speed up (freewheel) going down a slope. Engine or clutch braking effect is minimal.
- Balance loads evenly and secure them. Braking could shift the load and affect vehicle stability.
- Sit on the center of the seat and keep both feet within the foot platform.
- Never drive past the limit of visibility. Slow down near the crest of a hill until getting a clear view of the other side.
- If the vehicle stops or loses power going up a hill, lock the park brake to hold the vehicle on slope. Maintain direction of travel and release the brake slowly. Back straight down hill slowly while maintaining control. Do not turn the vehicle sideways. The vehicle is more stable in a straight forward or rearward position.
- If the utility vehicle begins to tip, turn the front wheel downhill to gain control before proceeding.

### **Riding Through Water**

- Avoid water whenever possible. If the drive belt becomes wet, slippage will occur and the vehicle will lose power.
- Never cross any body of water where the depth may be unknown to the operator. As an operational guideline, deep water is considered anything in excess of 152 mm (6 in.) in depth. Tires may float, making it difficult to maintain control.
- Choose a course within the waterway where both banks have a gradual incline. Cross at a point known to be safe.
- Proceed at a slow steady speed to avoid submerged obstacles and slippery rocks.
- Avoid water crossings where the operation of a utility vehicle may cause damage to waterway beds or erode waterway shoreline.

## FLD 34 UNDERGROUND UTILITIES

### REFERENCES

29 CFR 1926.651, *Specific Excavation Requirements*  
ANSI Standard Z 535.1, *American National Standard for Safety Color Code*

### RELATED FLDs

*FLD 42 – Lockout/Tagout*

This Field Operation Procedure (FLD) provides requirements for identification, location, and avoidance of underground utilities, appurtenances, and structures during intrusive activities. These requirements are applicable to all Weston Solutions, Inc. (WESTON) operations. The procedures address the requirements and recommendations for identifying and locating, working around, and encountering or contacting underground utilities. The FLD also addresses actions to be taken in response to encountering or contacting underground utilities.

### DEFINITIONS

#### Aggressive Methods

The use of mechanized equipment such as (but not limited to) excavators, backhoes, drill rigs, directional drilling, Geoprobe operations (including all direct push techniques), or road saws.

#### Buffer Zone

As defined in this procedure, the area around a utility where only non-aggressive excavation methods may be utilized, unless specific conditions are met.

The definition cited above, and the excavation requirements and restrictions associated with it, will vary depending on the particular state regulations. WESTON requires the imposition of a **three-foot** Buffer Zone on all sides of the utility as measured from the outside edges of the utility, both horizontally and vertically. State and/or local buffer zone requirements must be verified by consulting the applicable state regulations in the event buffer zones greater than three feet are required.

The term “Buffer Zone” may be referred to as the “Tolerance Zone”, “Safety Zone”, or “Approximate Location of Underground Utilities” in some jurisdictions.

#### Competent Person

A Competent Person has the ability to recognize hazards associated with underground utilities and the authority to stop or direct operations to ensure the safety of personnel and conformance with this procedure. The Competent Person has an understanding of this procedure, and the “One-Call” system requirements for the jurisdiction where excavation is occurring. The Competent Person must be capable of notifying One-Call agencies and maintaining and tracking One-Call Locate Numbers. Additionally, they must have knowledge of methods and work practices for excavation work and the identification, avoidance, and protection of underground utilities.

The designation of a Competent Person will be made by the Site Manager (SM) or Project Manager (PM) and documented in the site-specific Health and Safety Plan (HASP) or attachment to the HASP. Each WESTON Competent Person is required to successfully complete WESTON’s internal training program on the use and application of this FLD and possess appropriate and relevant field experience.

The names of Subcontractor Competent Persons will be documented in the Site-Specific *Subcontractor Acknowledgment: Supervisor Personnel, Competence of Personnel, and Task Understanding* form. Subcontractor Competent Persons will be expected to follow this FLD or their company's procedures, whichever is more restrictive.

### **Damage**

Damage may be considered as any undesired impact or unanticipated removal of support from an underground utility as a result of excavation or demolition. Damage may be as simple as minor contact (by any means) resulting in displacement of protective coating. The utility owner must be contacted regarding any damage or question of damage.

### **De-Energize**

As applicable to a utility, to physically eliminate and/or prevent the presence, transmission, flow, or release of energy or materials which may cause harm to personnel or property.

### **Excavation (Intrusive Activity)**

An operation using mechanized equipment for the purpose of movement or removal of earth, rock, or the materials in the ground, including but not limited to: digging, blasting, augering, test boring, drilling, pile driving, directional drilling, grading, plowing-in, hammering (including hammer-drill soil gas sampling tube installation), pulling-in, jacking-in, trenching, tunneling, structural demolition, milling, scraping, tree and root removal (grubbing), and fence or sign post installation. Note that in some States or jurisdictions, excavation may include hand augering or use of other hand tools.

### **Jurisdiction**

The Authority having legal jurisdiction for establishing and/or enforcing regulations and requirements for notification of excavation activities and associated identification and marking of underground utilities. In the United States, the States have jurisdiction, and most consider the regulations applicable when excavation is to be performed in any location, including any public or private way, any company right-of-way or easement, or any public or privately owned land or way. Note: One caveat to remember – Jurisdiction may flow to the “owner” on private or government-owned property because the State One-Call Agencies may not clear utilities on such facilities.

Note that easement boundaries may require differing methods for compliance assurance. Railroads and certain above ground utilities have easements that require specific procedures for excavation (including shoring and shielding of both the utility as well as for the track and/or poles). In these cases it may be required that an inspector or representative of the railroad or utility is present at all phases of the activity.

### **Locate**

To indicate the existence of a utility by establishing a mark through the use of flags, pins, stakes, paint, or some other customary manner, that *approximately* determines the location of a line or facility.

### **Locate Request**

A communication between an entity performing intrusive activities and a utility marking agency (One-Call, etc).

## Non-Aggressive Methods

Non-Aggressive methods involve the use of manual methods such as hand digging with shovels or by potholing or daylighting methods.

## Observer

The person assigned to visually monitor and, as needed, signal the operator during mechanized intrusive activity when the activity is occurring within three feet of the outside edge of the buffer zone. The observer remains in close communication with the equipment operator(s) and will stop the activity if needed.

## One-Call Agency

An entity that administers a system through which a person can notify owners/operators of underground lines or utilities of the intent to perform intrusive activities in proposed public areas. **It is important to note that not all underground utility owners may be required to join the One-Call system. Additionally, some underground utility owners may not comply with State registration requirements.** The SM or Competent Person is responsible to determine additional utilities that may need to be contacted individually.

## Positive Response

Verification prior to the intrusive activity, to ensure that all contacted (typically via the One-Call Agency) owner/operators have located and marked the underground utilities. The SM or Competent Person is responsible to determine/verify ownership of the property where the intrusive activity will occur, including any easements.

## Potholing or Daylighting

The practice of exposing an underground facility by safe, *non-aggressive* excavation methods in order to determine the precise horizontal and vertical position and orientation of underground lines or utilities. potholing or daylighting are terms used to describe the excavating of buried facilities using an air or water “knife” coupled with vacuum excavation that exposes underground utilizes to the “daylight” – a positive and safe means of identification and confirmation of exact utility location.

## Target Rich Environment

Areas where multiple utilities are known or suspected of being located, areas where utility locations are in question and/or difficult to obtain information on, or areas with known or suspect high-risk utilities. **Note: Military Bases (active or inactive) are to be considered “Target Rich Environments”.**

## Underground Utility

An underground or submerged conductor, pipe, or structure used in transporting or providing electric, communications service, gas, oil or oil product, sewage, storm drainage, water, or other service and appurtenances thereto. As used in this procedure, utility includes all underground appurtenances and structures.

The following are examples of the types of underground utilities that may be present in a given location:

- Natural gas pipelines
- Electric cables

- Water pipelines
- Fiber optic telecommunications lines
- Telephone cable lines
- Steam pipelines
- Gasoline, oil, or other fuels
- Sewer pipelines
- Vents for sewer and gasoline/diesel fueling systems
- Underground Storage Tanks (USTs)
- Abandoned underground structures containing hazardous materials, hazardous wastes, and radioactive materials

### **Underground Utility Owner**

Any person, utility, municipality, authority, political subdivision or other person or entity who owns, operates, or controls the operation of an underground line/facility.

### **White Lining**

The practice whereby the person (in this case WESTON or a Subcontractor) who intends to perform intrusive activities, pre-marks the site with an outline of the area where intrusive activities will occur. This involves the use of white paint, flags, stakes, or a combination thereof to mark the extent of where work is to be performed. The marking may vary depending on what intrusive activities are to be conducted. For example, for general excavation, an areal outline of the excavation shall be marked, while for drilling, the individual boreholes shall be marked. Studies have shown that pre-marking is a practice that does prevent utility contact incidents. Check State or local regulatory requirements to ensure compliance.

## **RESPONSIBILITIES**

### **Competent Person**

The Competent Person shall be responsible for:

- Obtaining a copy of, and understanding the applicable regulations for the state of jurisdiction where the excavation activities are to be performed.
- Contacting the appropriate One-Call Agency or private locating service, as applicable.
- Recording One-Call locate numbers.
- If necessary, renewing One-Call locate numbers before expiration.
- Ensuring that white-lining of the area to be excavated is performed; if another equal or better protective measure is necessary because of the nature of the work, state/local regulation, or client requirements, the HASP should be amended to reflect the change.
- Ensuring that a “positive response” has been received from every utility owner/operator identified by the One-Call Agency (and any non-member utility as necessary) and that they have located their underground utilities and have appropriately marked any potential conflicts with the areas of planned intrusive activities prior to the start of intrusive work.

- Ensuring that appropriate means for supporting and protecting any exposed utility have been discussed with the utility owner and such means are available on-site.
- Ensuring that above-ground utilities and other appurtenances will not create a problem, or be impacted by WESTON activities. In all cases provisions for protection of any utility, structure, or appurtenance must be made.
- Ensuring that provisions for emergency actions and emergency shut-off/mitigation of utilities have been discussed with utility owners and field personnel.
- Ensuring that pictures are taken before, during, and after intrusive activities and placing such pictures in the project file. Pictures should provide visual documentation of actual site conditions, including but not limited to exposed utilities, methods used for bracing utilities and markings placed on the surface by utility locating services. Consideration should also include placing of a known object in the picture field to provide a “scale” for size/distance comparison.
- Completion and maintenance of the Underground Utilities Locating and Marking Checklist (Attachment A) and the Underground Utilities Management Checklist (Attachment B).
- Reviewing applicable Activity Hazard Analyses (AHAs) with all project members before work begins.
- Conducting training on communication protocols to be used by the excavation observer and equipment operator.
- Ensuring implementation of appropriate work practices during intrusive activities (including maintaining the prescribed buffer zone for use of aggressive methods).
- Conducting daily or more frequent (due to changes in conditions) inspections of the excavation area to make sure that all markings are intact.
- Providing the Field Safety Officer (FSO) with all required documentation on a daily basis.

## **Observer**

Whenever intrusive operations with mechanized equipment are being conducted *within three feet of the outside edge of the buffer zone*, horizontally and vertically, an observer must be assigned to monitor the activities. The observer is responsible for:

- Maintaining a safe vantage point relative to digging machinery, excavation edge, and proximity to the hazard posed by the utility.
- Observing the operation to ensure that the operator stops operations if utilities are observed.
- Reviewing hand signals and other forms of communication with the operator. Note: hand signals should be as those identified under ANSI, OSHA, or the Corps of Engineers for Crane Hand Signals, or another, equally effective and understood system.
- Properly signaling the operator.
- Stopping the operation immediately if the observer’s attention must be diverted even momentarily.
- Stopping the operation immediately if a hand signal or other directive is not followed. Operations will not resume until the observer and operator mutually agree that the reason(s) for not complying with the directive(s) are/is identified and fully corrected.
- Maintaining required records, such as logbook entries, or other, as requested by line management.

## Line Management

The PM or SM shall be responsible for:

- Establishing the site culture with the assistance of the FSO that ensures compliance with this FLD, as well as providing the leadership to “do the right thing” whenever unanticipated circumstances arise.
- Providing the necessary resources, including sufficient schedule for compliance with this FLD.
- Designating a Competent Person or ensuring that a subcontractor Competent Person is designated, prior to the start of work.
- Discussing intrusive activity liability with the Client prior to the start of work. Best practices for identification of underground utilities must be included with the proposal and/or HASP, as well as WESTON’s requirement for Client sign-off (if the Client is the property owner or if the Client selects the drilling/intrusive action location) when identifying specific work locations for intrusive activities. In cases where the client, such as EPA, will or cannot sign off on liability or provide indemnification, discussions with the appropriate client representatives on intrusive activities will be documented in the project file.

**Note: In any ‘target-rich’ work environment, best practices must include the requirement for potholing/daylighting or careful hand-digging – whenever possible (at least 5 feet below grade) – since these are recognized processes for visually verifying the exact location of underground utilities while minimizing the potential for utility damage.**

- **For excavations using aggressive methods in target-rich environments**, consideration should be given for establishing an agreement with an Emergency Response Contractor and/or the specific utility owner prior to the start of intrusive activities. This agreement should include specific emergency notification procedures for each utility identified to ensure that timely response can be accomplished in the event of a utility strike.
- Determining/verifying ownership of the property where the intrusive activity will occur, including any easements.
- Contacting all utilities not notified directly by the utility notification center, including those known to local personnel and the property owner.
- Obtaining Profit Center Manager approval for any deviations from this FLD, including best practices, or for addressing any set of circumstances not specifically addressed in this FLD that may place WESTON or its employees at risk.

## Environmental, Health, and Safety Personnel

The FSO shall be responsible for:

- Providing oversight on the implementation of the requirements contained in this FLD.
- Consulting with the PM, SM, Competent Person, and the appropriate Division Environmental, Health, and Safety Manager (DEHSM) (or Corporate EHS) on underground utility issues.
- Acting as the Competent Person or Observer as necessary and qualified.

## Procedure

The following sections provide the requirements and recommendations, which are intended to prevent injury to personnel, damage to infrastructure, and associated indirect effects associated with encountering

or contacting underground utilities during intrusive work. Underground utilities present multiple potential hazards that must be recognized before and during work which occurs near them, therefore, this procedure is divided into sections addressing underground utility identification and location, working around or near underground utilities, and actions to be taken in the event that underground utilities are encountered or contacted. Hazards that may be presented by underground utilities include explosion and fire, electrocution, toxic exposures, pathogens, and drowning.

### Identifying and Locating Underground Utilities

The potential for underground utilities or other subsurface feature (e.g., subsurface mines) must be evaluated as early as possible in the planning phase for any project which involves intrusive activities. The following sections describe various methods for identifying and locating utilities on a site. The *Underground Utilities Locating and Marking Checklist* (Attachment A) and the *Underground Utilities Management Checklist* (Attachment B) must be completed before any activities meeting the definition of excavation are conducted. Attachment A is intended to be used as a guide during the process of locating and marking utilities in the area to be excavated. Attachment B is intended to be used as a guide in the overall process of underground utilities management during the course of the project.

**Note:** Attachments A and B or their equivalents must be used to document compliance with this FLD and will be subject to audit.

Prior to excavation all underground utilities must be located and identified by at least two of the following:

- The Utility Owner
- The Property Owner
- A Private or Public Utility Locating Service
- Review of the most current utility drawing, maps or other available records by an approved WESTON Competent Person
- Use of utility locating technology by a WESTON Competent Person or subcontractor – this includes the use of potholing or daylighting in a “target-rich” work environment or whenever a full clearance (without restrictions) cannot be obtained from a utility locating service.

As an aid in determining the potential for or existence of utilities follow the criteria outlined in Attachment C (Utilities Research Options).

### Pre-Planning and the Site HASP

The site-specific HASP developed for the project must:

- Identify the location and types of underground utilities that are believed to be present on the site.
- Reference this procedure (FLD 34), and describe how it will be implemented on the project.
- Contain an AHA in which the hazards associated with underground utilities are identified, as well as the measures used to control them.
- Contain any site or contract-specific requirements (e.g., Corps of Engineers, EM 385-1-1, Section 25) that may be applicable.
- Contain clear and concise procedures to be followed in the event that contact with underground utilities occurs.



- Address underground utilities and potential associated scenarios in the emergency response section of the HASP.








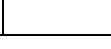
#### “One-Call” Locating and Marking Services

Every state has utility marking service programs that have various names such as “One-Call”, “Dig-Safe”, “Call-Before-You-Dig”, “Dig-Safely”, and many others. These services will identify the types and locations of any utility that may exist in an area to be excavated, as long as the property is in the public domain.

- The appropriate One-Call service for the jurisdiction where the project is located must be contacted prior to beginning excavation work. The One-Call Agency should be given as detailed a description of the property as possible; address, cross street, utility pole numbers, physical description, etc.
- Notification to the One-Call service shall allow sufficient lead-time for the Agency to mark the utilities before excavation begins. The lead times vary, but range from two to ten days, depending on the state of jurisdiction.
- In the event the State or Local One-Call service number is in question call "811" (the Federal Call before You Dig Number) for access to the appropriate locator service.
- A complete listing of One-Call agencies and telephone numbers for all states is available in the “*Call-Before-You-Dig Call Center Directory*”, which can be accessed on the Internet at the WebPage (<http://underspace.com/index.htm>) sponsored by “*Underground Focus*” magazine.
- Once notified, the One-Call Agency will provide the contractor with a unique “locate number” or “reference number”. This reference number must be kept in the project files by the Competent Person or designee. Additionally, the reference numbers have expiration dates, which may vary depending on the particular One-Call Agency. The valid period of the locate number and required renew notification date shall be requested from the One-Call Agency.
- On a project with multiple contractors, each contractor must request a separate locate number. Under no circumstances will any other contractor or entity be allowed to “work under our locate number”. Subcontractors to WESTON may excavate under the locate number secured by WESTON, provided that they are excavating within the area which was previously white-lined by WESTON and subsequently marked. **However, the One-Call Agency must be contacted and notified of this arrangement so that the subcontractor can be recorded as working under the existing locate number.** If a WESTON subcontractor will be excavating in an area not white-lined by WESTON, then the WESTON subcontractor must request a new locate. **Note: State and local requirements must be checked for local application of this procedure.**
- The area where work is to be performed shall be white-lined before the locating service goes to the site.
- It is good practice to arrange a pre-excavation meeting at the project site with the personnel performing the utility location and marking. This meeting will facilitate communications, coordinate the marking with actual excavation, and assure identification of high-priority utilities.
- The One-Call Agency should provide the identities of the utility owners that will be notified of the locate request. This information shall be recorded on the Underground Utilities Locating and Marking Checklist (Appendix A) and maintained in the project files. The contact person and phone number for each utility owner shall also be recorded. ***Note that all utility owners are not members of the One-Call system.*** This does not eliminate the need to contact a non-member owner if you have knowledge or suspect that excavation will impact their utility.

- The utility owners should provide a “positive response” relative to the locate request, which can consist of two types of action by the utility owner. The facility owner or operator is required to 1) mark its underground utilities with stakes, paint, or flags, or 2) notify the excavator that the utility owner/operator has no underground utilities in the area of the excavation.
- The positive responses shall be recorded on the Underground Utilities Locating and Marking Checklist (Attachment A) and crosschecked with the list of utility owners that the One-Call Agency stated they would notify. If it is discovered that a utility owner has not provided a positive response, then the One-Call Agency must be notified.
- Excavation shall not be conducted until positive responses have been received from all utility owners identified by the One-Call Agency as having underground utilities on the property.
- Before beginning excavation, the excavator must verify that the location marked was correct, and the distinct, color-coded markings of all utility owners are present.
- Examine the site to check for any visible signs of underground utilities that have not been located and marked such as pedestals, risers, meters, warning signs, manholes, pull boxes, valve boxes, patched asphalt or concrete pavement, areas of subsidence, fresh sod or grass, lack of grass or vegetation, and new trench lines.
- The markings placed by the utility owners should be documented by WESTON using a still, digital, or video camera, whenever practical and reasonable. The photo-documentation shall be maintained with the project files.
- The markings placed by the utility owners or marking services typically follow the American Public Works Association Uniform Color Code as described in ANSI Standard Z 535.1. This code follows:

#### **American Public Works Association Uniform Color Code**

Red		Electric Power Lines, Cables, Conduit
Orange		Communications, Telephone, Cable TV
Yellow		Gas, Oil, Steam, Petroleum or Gaseous Materials
Green		Sewers and Drains
Blue		Potable Water Systems
Purple		Reclaimed Water, Irrigation, Slurry Lines
Pink		Temporary Survey Markings
White		Proposed Excavation

**Note:** Unless otherwise specified in the utility clearance, such clearance will not be considered valid after 30 days from the date it was issued.

#### Private Utility Locating and Marking Services

- **One-Call agencies arrange for the identification and marking of underground utilities only on public property, up to the point of contact with private property.** In the event that activities are to be conducted on non-public properties, the presence, location, depth, and orientation of all underground utilities shall be ascertained through records review, including any site plot plans, utility layout plans, and as-built drawings available from the property owner, as well as through interviews with knowledgeable personnel associated with the property (See Attachment C). Additionally, for excavations using aggressive methods in target-rich

environments or other situations where utility locations are in question, the information gathered from these sources shall be verified by physical detection methods (non-aggressive), performance of a geophysical survey, or by procuring the services of a private utility locating and marking service. If any detection methods are to be self-performed, the requirements within this FLD must be followed. **A list of vendors providing this service can be found in the “Network of Underground Damage Prevention Professionals” which can be accessed on the Internet at the “Underspace” WebPage (<http://underspace.com/index.htm>).**

#### Self-Performance of Utility Locating and Marking

The techniques and instruments used to locate and characterize underground utilities can be extremely complicated and difficult to use effectively. Additionally, interpretation of the data generated by this instrumentation can be difficult. The utility marking services, as previously described are staffed by well-trained, experienced professionals who perform locating activities on a regular basis. For these reasons, it is most desirable that these professional services are used for utility location and marking on projects.

- In some instances on private property or in other areas not served by One-Call agencies (e.g., long-term projects where excavation is a primary task, and the presence of underground utilities is extensive) it may be prudent to self-perform locating and marking activities.
- If locating and marking is to be self-performed, all personnel using instrumentation will be trained on the use of the equipment that will be used, and the interpretation of the data.
- There are a variety of locating methods which may be utilized for self-performance of utility locating as categorized below:
  - Magnetic field-based locators or path tracers
  - Buried electronic marker systems (EMS)
  - Ground penetration radar-based buried –structure detectors
  - Acoustics-based plastic pipe locators
  - Active probes, beacons, or sondes for non-metallic pipes
  - Magnetic polyethylene pipe
- Before self-performing any underground utility locating on a project, approval must be obtained from the appropriate WESTON DEHSM or the Corporate EHS Director.

#### **Working Near or Around Underground Utilities**

After the site has been properly evaluated for the presence of aboveground utilities, underground utilities, and other appurtenances, intrusive activities may begin. Because there is no perfect way of eliminating the hazards presented by underground utilities, an effort must be made to perform the tasks following the direction and guidance as described by the following best practices that should be implemented during the execution of the project.

#### Work Site Review

Before beginning intrusive activities, a meeting shall be held between all members of the project team. This shall consist of a review of the marked utility locations with the equipment operators, observers, laborers, etc.

#### Preservation of Marks

During excavation, efforts must be made to preserve the markings placed by the utility owners until they are no longer required. If any markings are obliterated, the One-Call Agency must be contacted for re-marking. No intrusive activities are to take place if markings are not visible.

### Excavation Observer

Whenever intrusive operations are being conducted within three feet of the edge of the buffer zone, an observer must be assigned to monitor the activities. The observer will be designated each day, and a review of hand signals and other forms of communication between the observer and operator will be conducted. The directives of the observer will be followed precisely and immediately by those operating equipment.

### Excavation Within The Buffer Zone

Mechanical means of excavation may not be used within 36 inches (see Buffer Zone) of any marked or suspect utility until the utility has been exposed. Mechanical methods may be used, as necessary, for initial penetration and removal of pavement, rock or other materials requiring use of mechanical means of excavation provided a spotter is used. Once the underground utility has been exposed, further excavation must be performed, employing reasonable precautions to avoid damage to the utility, including but not limited to any substantial weakening of structural or lateral support, or penetration or destruction of the utility or its protective coatings. For purposes of this section, “mechanical means of excavation” means excavation using any device or tool powered by an engine except air vacuum or like methods of excavation.

A request to utilize aggressive excavation methods in the buffer zone may be made if:

- There is no other appropriate and reasonable alternative to using aggressive methods in the buffer zone; and
- The utility has been de-energized (and purged if necessary), verified as de-energized, and locked-out; or
- The depth and orientation of the utility has been adequately and visually determined through the use of non-aggressive methods such as air/hydro/vacuum excavation, potholing, probing, hand-digging, or a combination thereof; and
- For utilities containing electrical energy, the depth of the existing water table is below the location of the utility; and
- Request for the exemption has been submitted to the appropriate DEHSM and Profit Center Manager for approval.

The following conditions will apply to this request:

- Aggressive methods may be used in the buffer zone only to the extent allowed by the applicable state or other jurisdictional regulations.
- Appropriate physical protection measures for exposed utilities shall be implemented to eliminate the potential for equipment contact with utilities.
- The extent of the project excavation area to be covered by the exemption request must be specified in the request for exemption.
- When evaluating the use of aggressive excavation methods in the buffer zone, the DEHSM will consider the type of utility involved and the associated risk potential. Based on this evaluation, the Profit Center Manager and/or DEHSM may impose further conditions and requirements. Even if the above exemption conditions are met, the DEHSM has authority to deny the request.

Unless exempted according to the above provisions of this procedure, only non-aggressive methods may be used within the buffer zone. These methods are used in order to prevent mechanical contact with underground utilities, which could result in damage to the utility and create the potential for personal injury and property damage. Following are examples of non-aggressive excavation methods:

- Hand-digging
  - Non-conductive hand tools must be used when digging within the buffer zone surrounding underground electrical utilities.
  - If conductive hand tools must be used near electrical lines, then the FSO and/or DEHSM shall be consulted to determine additional requirements relative to safe electrical practices, procedures, and equipment.
- Hydro-excavation (water pressure).
- Air excavation (air pressure).
- Vacuum extraction (soil excavation/removal).
- Air excavation/vacuum extraction combination.
- Aggressive methods may be used for the removal of pavement over a utility, if allowed by the state regulations.

#### Protection of Underground Utilities

It is very important that consideration be given to the protection of underground utilities when performing adjacent intrusive activities. This is necessary not only to prevent physical damage and associated indirect effects, but also to prevent the potential for injury to employees and the public.

- When using aggressive excavation methods within the buffer zone around exposed underground utilities, physical protection must be used as required by OSHA in 29 CFR 1926.651. Basically, this involves creation of a physical barrier between the mechanized operation and the utility. The following are some possible types of physical protective measures:
  - Heavy timbers, similar to swamp or crane mats.
  - Sheets of plywood.
  - Blasting mats.
- Once exposed, underground utilities no longer have the support provided by surrounding soil and may need to be physically supported to prevent shifting, bending, separation, or collapse, which could result in damage to the utility, and possibly personnel. Following are suggested support methods:
  - Timber shoring underneath the utility.
  - Timbers or girders over the top of the excavation fitted with hangers that support the utility.
  - Design by a Professional Engineer for complicated or large applications.
- Utilities must also be protected from objects that may fall into the excavation such as rocks and equipment. This can be accomplished by following these guidelines:
  - Cast spoils as far away from the excavation as possible. Excavated and loose materials shall be kept a minimum of two feet from the edge of excavations.
  - Relocate large rocks, cobbles, and boulders away from the excavation and sloped spoils piles.

- When vehicles and machinery are operating adjacent to excavations, warning systems such as soil berms, stop logs or barricades shall be utilized to prevent vehicles from entering the excavation or trench.
- Scaling or barricades shall be used to prevent rock and soils from falling into the excavation.
- Barriers shall be provided to prevent personnel from inadvertently falling into an excavation.

### De-Energizing Utilities

Utilities can carry many types of potential energy, including electricity, flowing liquids, liquids under pressure, or gasses under pressure. A release may happen if a utility conveyance is compromised and could result in personal injury, property damage, and other indirect effects. If the white lines of the proposed excavation area overlaps or extends into the buffer zone of a known underground utility, then if at all possible, that utility should be de-energized to physically prevent the transmission, flow, or release of energy. Conversely, if the buffer zone of the known utility lies outside of the white-lined, proposed excavation area, then de-energizing is not required.

- The owner of the utility shall be contacted to determine the feasibility and methodology of de-energizing the utility. Plenty of lead-time should be provided for this since it may take utility companies weeks to de-energize some utilities.
- Depending on the utility and the material being conveyed, isolation points which may be suitable for de-energizing include but are not limited to the following:
  - Electrical circuit breakers
  - Slide gate
  - Disconnect switches
  - Piping flanges
  - Other similar devices
- When utilities are de-energized, it must be verified by demonstration. This can be accomplished by methods such as, testing equipment, switching on a machine or lighting, or opening a valve. For any current-carrying electrical equipment, such as cables or electrical panels, successful de-energizing must be certified through the use of appropriate electrical testing equipment and qualified personnel.
- Whenever a utility is de-energized, a means of ensuring that the energy isolation device and equipment cannot be operated until the device is removed must be provided.
- When de-energizing and locking out of utilities is practiced, the provisions of FLD 42 Lockout/Tagout shall be followed, as applicable.

### Damage Discovery

During excavation, utility damage may be discovered which is pre-existing or otherwise not related to a known contact. Disclosure to the utility owner is very important because the possibility of utility failure or endangerment of the surrounding population increases when damage has occurred. The utility may not immediately fail as a result of damage, but the utility owner or operator must be afforded the opportunity to inspect the utility and make a damage assessment and effect repairs if necessary. The following guidance applies:

- Observe and photograph the utility from a safe distance and determine if there is damage. Damage would be all breaks, leaks, nicks, dents, gouges, grooves, or other damages to utility lines, conduits, coatings, or cathodic protection systems.

- The owner of the affected utility must be contacted immediately.
- The One-Call Agency or private location service must be contacted immediately.
- A Notification of Incident (NOI) Report will be used to document such a discovery.

#### Encountering Unexpected Underground Utilities

It is possible that underground utilities will be encountered in locations that have previously been “cleared” of having underground utilities by the locating service, or are found outside of the area, which has been marked as having underground utilities. In either case, if this occurs, the following applies:

- Site personnel must be warned and moved to a safe location; equipment engines and ignition sources should be turned off, if possible, as the operator is exiting his/her equipment.
- Intrusive activities must be stopped.
- The owner of the affected utility must be immediately contacted.
- The One-Call Agency or private location service must be contacted immediately.
- The PM, SM, and FSO must be notified.
- No further intrusive activities may be conducted until:
  - The One-Call Agency/private location service and/or the subject utility owner visit the site;
  - Identification of the utility owner and the type of material/energy being conveyed by the utility has been made; and
  - The orientation and depth of the subject utility has been determined and suitably marked.
- A NOI Report must be completed. The report should be accompanied by photographs clearly showing the marking(s), and the actual location, with a distance gauge to document how far off the mark the utility was encountered.

#### Contacting Underground Utilities

If excavation or other equipment being used for intrusive activities makes contact with an underground utility, the following guidelines apply:

- Site personnel must be warned and moved to a safe location; equipment engines and ignition sources should be turned off, if possible, as the operator is exiting his/her equipment.
- Intrusive activities must be stopped immediately.
- Observe the utility from a safe distance and determine if there is damage. Damage would be all breaks, leaks, nicks, dents, gouges, grooves, scratched coatings, cathodic protection compromise, material leakage, obvious electrical energy.
- Move all personnel to the evacuation meeting point as described in the HASP.

***EXCEPTION:*** *If an electrical line has been contacted and it is your belief that equipment (such as an excavator) is electrically energized, do not approach the equipment. Order the operator to remain in the equipment until emergency personnel can de-energize the source (unless the equipment is on fire, at which time the operator should jump off of the vehicle and shuffle along the ground to a safe area). Shuffling is required because current flows outward through the soil in a ripple pattern called a power gradient, creating a pattern of high and low potential, Shuffling decreases the chance that these gradients could be bridged, causing current to flow through the body, resulting in electrocution.*

- Secure the area to prevent the public from entering.
- Contact emergency responders as specified in the HASP.
- Immediately contact the One-Call Agency or if known, the utility owner.
- Notify the PM, SM, FSO and DEHSM.
- No further intrusive activities may be conducted until:
  - The utility owner inspects the scene and after repairs, verifies that all danger has passed.
  - The orientation and depth of the subject utility has been determined and suitably marked.
  - Permission from the emergency responders to resume work has been given.
- A WESTON NOI Report must be completed. The report should be accompanied by photographs clearly showing the marking(s), and the actual location, with a distance gauge to document how far off the mark the utility was encountered.
- State and Local regulations must be reviewed to determine if reporting to any additional agencies is required.

## **ATTACHMENTS**

Attachment A – Underground Utilities Locating and Marking Checklist

Attachment B – Underground Utilities Management Checklist

Attachment C – Utilities Research Options

Attachment D – Sources of Information

Informational Addendum 16 June 2010



**ATTACHMENT A**  
**UNDERGROUND UTILITIES LOCATING AND MARKING CHECKLIST**

*Weston Solutions, Inc.*

To be Completed by PM and/or "Competent Person"  
 Complete Form as Location/Marking Progresses and Maintain in Site Files

<b>PROJECT INFORMATION:</b>	<b>Location:</b>
<b>Project Name:</b>	Task/Activity:
WESTON Competent Person:	Start Date of Work:
WESTON Subcontractor: <input type="checkbox"/> No <input type="checkbox"/> Yes:	Private Locating Service Required: <input type="checkbox"/> Yes <input type="checkbox"/> No
Subcontractor Competent Person:	If Not, Explain:
Property Owner:	
<b>NOTIFICATION:</b>	
<b>Locating Service Name:</b>	Locating Service Tel. Number:
Date Locating Service Notified:	Locate Ticket Number:
Address of Property to be Marked:	Locate Ticket Expiration Date:
Nearest Intersecting Street:	
Are There Any Utilities on the Properties That the Locating Service Will Not Contact? <input type="checkbox"/> Yes <input type="checkbox"/> No	
Specify:	

*Enter Utility Information in Table 1 Below. In Addition to Utility Locating Services, Consult Client, Utility Owners, Drawings, Facility Personnel, Maintenance Personnel, Municipalities (See Appendix C).*

**Table 1. On-Site Utility Information**

Name of Utility Company	Type of Utility	Color Code	Utility Present On-Site?	Emergency Phone Number	Date Marks Completed
	Electric	RED			
	Communications, Phone, CATV	ORANGE			
	Gas, Oil, Steam, Petroleum	YELLOW			
	Sewers, Drains	GREEN			
	Potable Water	BLUE			
	Reclaimed Water, Irrigation	PURPLE			
	Temporary Survey Markings	PINK			
To be performed by excavator prior to utility mark-out.	Proposed Excavation	WHITE			

White-Lining Completed?

☐ No Explain: \_\_\_\_\_ ☐ Yes: Date: \_\_\_\_\_ By Whom? \_\_\_\_\_

**LOCATING AND MARKING:**

Have All Utilities Identified in Table 1 Been Marked?

☐ Yes ☐ No (If No, Contact Locating Service for Resolution)

Problem(s) With Markings?

☐ Yes ☐ No ☐ No Marks ☐ Incorrect Location ☐ Too Wide

☐ Other: \_\_\_\_\_ ☐ Not All Utilities Marked Per Table 1 (notify marking service)

Measurements Taken: ☐ Yes ☐ No

Documentation of Marks: ☐ Photos ☐ Video ☐ Other: \_\_\_\_\_

**EXCAVATION:**

Utilities Accurately Marked? ☐ Yes ☐ No

If no, describe: \_\_\_\_\_

Were Unmarked or Mis-Marked Utilities Encountered? ☐ Yes ☐ No

If Yes, Specify: \_\_\_\_\_

Locating Service Notified? ☐ Yes ☐ No

Will Excavation Continue Past Locate Number Expiration? ☐ Yes ☐ No

If Yes, Locate Number Renewed? ☐ Yes ☐ No New Expiration Date: \_\_\_\_\_

Any Other Problems/Concerns? Specify: \_\_\_\_\_

Form Completed By:	Signature:	Date:
--------------------	------------	-------

**ATTACHMENT B**  
**UNDERGROUND UTILITIES MANAGEMENT CHECKLIST**

*Weston Solutions, Inc.*

To be Completed by PM and/or “Competent Person”

Complete Form as Project Progresses and Maintain in Site Files.

PHASE	TASK		YES	NO	NA	COMMENTS Required if Response is No or NA. (Reference Item Number)
<b>Pre-Planning</b>	1	Excavation/Best Practices in Work Scope?				
	2	Underground Utilities Identified?				
	3	Competent Person Assigned?				
	4	Has a Copy of the Applicable State Regulations Been Obtained, Read, Understood?				
	5	EHS Plan Addresses Underground Utilities? (AHAs, Contingency Plan, State Regulations Appendix)				
<b>Identifying, Locating and Marking</b>	6	Locating and Marking Checklist Initiated? (Attachment A)				
	7	Identification and Address of Property Determined, Including Nearest Intersection?				
	8	One-Call Agency Contacted?				
	9	Additional Locating and Marking Required on Property? (One-Call agency marks to public property line only)				
	10	Additional Marker/Locator Identified?				
	11	Additional Marker/Locator Qualified?				
	12	Weston Self-Performing Location and Marking?				
	13	If Yes to 12 Above, Approval From Division EHS Manager?				
	14	Area of Excavation “White-Lined” by WESTON?				
	15	WESTON Present When Markings Completed?				
	16	All Utilities Marked? (Refer to Attachment A, Table 1)				
	17	All Markings Photo/Video Documented?				

PHASE	TASK		YES	NO	NA	COMMENTS
						Required if Response is No or NA. (Reference Item Number)
<b>Identifying, Locating and Marking – Continued</b>	18	Area Checked for Signs of Previous Excavation? (Subsidence, new grass, patching, etc)				
	19	All Applicable Information Recorded on Attachment A?				
	20	Multiple Contractors Excavating On-Site?				
	21	Separate Locate Requests for All Contractors?				
	22	WESTON Subcontractors Excavating in WESTON White- Lined Area(s)?				
	23	If Yes to 22 Above, One-Call Agency Contacted to Determine if WESTON Subcontractor Can be Added to Existing Locate Ticket?				
<b>Excavation Activities</b>	24	Meeting and Site Walkover Conducted with Project Personnel?  (Managers, Equipment Operators, Laborers, Competent Person, Excavation Observer, etc)				
	25	AHA and HASP Review Conducted With Personnel?				
	26	Do Site Activities Have Potential to Obliterate Utility Markings?				
	27	If Yes to 26 Above, Have Provisions Been Made to Preserve Markings?				
	28	Has an Excavation Observer Been Designated to Monitor Excavation When Occurring within 3 Feet of the Buffer Zone?				
	29	Have Operator and Observer Reviewed Commands and Signals?				
	30	Has WESTON-Required Buffer Zone Been Marked on Either Side of Markings Placed by Locator?				

PHASE	TASK		YES	NO	NA	COMMENTS Required if Response is No or NA. (Reference Item Number)
<b>Excavation Within Buffer Zone</b>	31	Is Excavation Within The Buffer Zone Absolutely Necessary?				
	32	If Yes to 31 Above, Can Non-Aggressive Methods Be Used For Excavation In The Buffer Zone? If Yes, Identify Appropriate Non-Aggressive Methods.				
	33	If No to 32 Above, Has a Buffer Zone Exemption Request Been Approved? If No, then Aggressive Methods May Not Be Used in The Buffer Zone.				
	34	If Yes to 33 Above, Has the Utility Been De-Energized, Purged, Verified/Tested, and Locked-Out? Or,  Has The Depth and Orientation of the Utility Been Adequately and Visually Determined Through The Use of Non-Aggressive Methods?				
	35	If Yes to 34 Above, Have All of The Following Conditions Been Met?  For Utilities Containing Electrical Energy, Is The Depth of The Water Table Below The Depth of The Utility?  Have Regulations Been Consulted to Determine Specific State Requirements Relative to Excavating in The Buffer Zone?  Have Appropriate Physical Protection Measures Been Implemented to Prevent Equipment Contact With Utilities and to Prevent Damage to Utilities?  If No to Any of The Above Conditions, Then Only Non-Aggressive Excavation Methods May Conducted in The Buffer Zone, Since The Conditions of The Exemption Have Not Been Satisfied.				
<b>Working Around Exposed Utilities</b>	36	If Necessary, Have Provisions Been Made to Support the Utility During Work Activities?				
	37	Have Spoils Been Placed as far Away From the Excavation as Feasible?				

PHASE	TASK		YES	NO	NA	COMMENTS Required if Response is No or NA. (Reference Item Number)
<b>Working Around Exposed Utilities – Continued</b>	38	Has the Utility Been De-Energized? (If Any Portion of the Buffer Zone around a Utility is Inside of the White-Lined Area)				
	39	Has the Isolation Point for the De-Energized Utility Been Physically Locked-Out?				
	40	If No to 39 Above, Has a Spotter Been Assigned to Monitor Isolation Point?				
	41	If Yes to 40 Above, Does the Spotter Have Adequate Communications? (Radio, Telephone, etc)				
	42	Has the Isolation Point Been Tagged?				
<b>Damage Discovery</b>	43	Has Pre-Existing Damage to a Utility Been Discovered During Excavation?				
	44	If Yes to 43 Above, Has the One-Call Agency and/or Utility Owner Been Notified?				
	45	If Yes to 43 Above, Have Photographs Been taken?				
<b>Encountering or Contacting Underground Utilities</b>	46	Have Utilities Been Encountered in Locations That Have Not Been Marked?				
	47	If Yes to 46 Above, Has the One-Call Agency or Other Locating Service Been Contacted?				
	48	If Yes to 46 Above, Has the PM and Appropriate DSM Been Notified?				
	49	If Yes to 46 Above, Has a WESTON Notification of Incident (NOI) Report Been Completed? (Include Photographs)				
	50	Have Excavation Equipment Come In Contact With Underground utilities?				
	51	If Yes to 50 Above, Were Intrusive Activities Immediately Curtailed?				

PHASE	TASK		YES	NO	NA	COMMENTS
						Required if Response is No or NA. (Reference Item Number)
<b>Encountering or Contacting Underground Utilities – Continued</b>	52	If Yes to 50 Above, Has a Damage Determination Been Made From a Safe Distance?				
	53	If Yes to 50 Above, Has the Area Been Secured?				
	54	If Yes to 50 Above, Have Emergency Responders Been Notified?				
	55	If Yes to 50 Above, Has the Locating Agency and/or Utility Owner Been Notified?				
	56	If Yes to 50 Above, Have State and Local Reporting Requirements Been Met?				
	57	If Yes to 50 Above, Were Intrusive Activities Curtailed Until Inspection From Utility Owner, Orientation and Depth of Utility Was Determined and Marked, Permission From Emergency Responders Given?				
	58	If Yes to 50 Above, Has a WESTON Notification of Incident (NOI) Report Been Completed? (Include Photographs)				

CHECKLIST COMPLETED BY:

_____ NAME	_____ SIGNATURE	_____ DATE
_____ NAME	_____ SIGNATURE	_____ DATE

**ATTACHMENT C**  
**UTILITY RESEARCH OPTIONS**

In the course of determining and verifying underground utility location it is expected that a minimum of two resources will be used. As a means of assisting the search for sources, the following is offered.

Records Sources:

- ☐ Utility Section of the State DOT or other Public Agency
- ☐ One-Call Center
- ☐ Public Service Commission or similar organization
- ☐ County Clerks Office
- ☐ Landowner
- ☐ Internet or Computer database
- ☐ Visual Site Inspection
- ☐ Utility Owner

From the Above Collect:

- ☐ Previous construction plans in the area
- ☐ Conduit maps
- ☐ Direct-Buried Cable records
- ☐ Distribution maps
- ☐ Service record maps
- ☐ As-built and record drawings
- ☐ Field notes
- ☐ County, city, utility owner or other geographic information system database
- ☐ Circuit diagrams
- ☐ Oral histories (current or previous employees, residents).

Review Records and Obtain Information For:

- ☐ Indications of additional and/or other available records
- ☐ Duplicate information that lends credibility to data
- ☐ Any additional need for clarifications from owners/others



## **ATTACHMENT D SOURCES OF INFORMATION**

### Organizations

- Common Ground Alliance  
<http://www.commongroundalliance.com/wc.dll?cga~toppage>
- Center for Subsurface Strategic Action (CSSA)  
<http://underspace.com/cs/index.htm>
- DigSafely  
<http://www.digsafely.com/digsafely/default.asp>
- National Utility Contractors Association (NUCA)  
<http://www.nuca.com/>
- National Utility Locating Contractors Association (NULCA)  
<http://underspace.com/nu/index.htm>
- Underground Focus Magazine  
<http://underspace.com/uf/index.htm>
- NUCA State Listing of One-Call centers  
<http://www.nuca.com/>
- Utility Safety Magazine  
<http://www.utilitysafety.com/>

### Vendors and Commercial Sites

- RadioDetection, Inc. (Detection Instruments)  
<http://www.radiodee.com/>
- Heath Consultants (Detection Instruments)  
<http://www.heathus.com/>
- Ben Meadows Company (Detection Instruments)  
<http://www.benmeadows.com/cgi-bin/SoftCart.exe/index.html?E+scstore>
- So-Deep, Inc. (Complete Utilities Services)  
<http://www.sodeep.com/>
- Concept Engineering Group, Inc. (Air Excavation Equipment)  
<http://www.air-spade.com/index.html>
- Rycom Instruments, Inc. (Detection Instruments)  
<http://www.rycominstruments.com/>

- Schonstedt Instrument Company (Detection Instruments)  
<http://www.schonstedt.com/>
- Forestry Suppliers, Inc. (Fiberglass Probe – “Fiberglass Tile Probe”, Part #77543,  
Approx. \$20.00, Telephone 800-647-5368)  
<http://www.forestry-suppliers.com/>

## **REFERENCES**

Common Ground Study of One-Call Systems and Damage Prevention Best Practices, August 1999,  
Sponsored by US DOT.

---

**INFORMATIONAL ADDENDUM**  
**16 JUNE 2010**

---

# **Overview of Underground Utility Detection Methods**

## **Induction Utility Locators**

Induction utility locators operate by locating either a background signal or by locating a signal introduced into the utility line using a transmitter. There are three sources of background signals that can be located. A utility line can act like a radio antenna, transmitting electromagnetic signals that can be picked up with a receiver. AC power lines have a 50HZ signal associated with them. This signal occurs in all active AC power lines regardless of voltage. Utilities in close proximity to AC power lines or used as grounds may also have a 50HZ signal that can be located with a receiver. A signal can be indirectly induced onto a utility line by placing the transmitter above the line. Through a process of trial and error, the exact above position can be determined. A direct induced signal can be generated using an induction clamp. The inductor clamp induces a signal on specific utilities. This is the preferred method of tracing, where possible. By virtue of the closed loop, there is little chance of interference with the resulting signals. When access can be gained to a conduit, a flexible insulated trace wire can be used. The resulting signal loop can be traced. This is very useful for non-metallic conduits. Finally, these signals can be located horizontally on the surface using a receiver. The receiver is moved across the estimated location of the utility line until the highest signal strength is achieved. This is the approximate horizontal location of the utility. The receiver is then rotated until minimal signal strength is achieved. This will give the approximate orientation of the utility. Vertical depth, however, derived from this equipment is subject to gross error.

## **Magnetic Locators**

Ferrous Metal or Magnetic locators operate by indicating the relative amounts of buried ferrous metals. They have limited application to locating and identifying utility lines but can be very useful for locating underground storage tanks (UST's) and buried manhole covers or other subsurface objects with a large ferrous metal content.

## **Electromagnetic Surveys**

Electromagnetic survey equipment is used to locate metallic utilities. This method pulses the ground and records the signal retransmitted back to the unit from subsurface metal. Particularly useful for locating metal pipelines and conduit, this device also can help locate other subsurface objects such as UST's, buried foundations (that contain structural steel), and pilings and pile caps (that also contain steel).

## **Ground Penetrating Radar**

Ground Penetrating Radar (GPR) is an electromagnetic method that detects interfaces between subsurface materials with differing dielectric constants (a term that describes an electrical parameter of a material). The GPR system consists of an antenna, which houses the transmitter and receiver; and a profiling recorder, which processes the received signal and produces a graphic display of the data. The transmitter radiates repetitive short-duration EM signals into the earth from an antenna moving across the ground surface. Electromagnetic waves are reflected back to the receiver by interfaces between materials with differing dielectric constants. The intensity of the reflected signal is a function of the contrast in the dielectric constant at the interface, the conductivity of the material, which the wave is traveling through, and the frequency of the signal. Subsurface features which may cause such reflections are: 1) natural geologic conditions such as changes in sediment composition, bedding and cementation horizons, voids, and water content; or 2) man-introduced materials or changes to the subsurface such as soil backfill, buried debris, tanks, pipelines, and utilities. The profiling recorder receives the signal from the antennae and produces a continuous cross section of the subsurface interface reflections, referred to as reflectors.

Depth of investigation of the GPR signal is highly site specific, and is limited by signal attenuation (absorption) of the subsurface materials. Signal attenuation is dependent upon the electrical conductivity of the subsurface materials. Signal attenuation is greatest in materials with relatively high electrical conductivity such as clays and brackish groundwater, and lowest in relatively low conductivity materials such as unsaturated sand or rock. Maximum depth of investigation is also dependent on antennae frequency and generally increases with decreasing frequency; however, the ability to identify smaller features is diminished as frequency decreases.

The various GPR antennas used are internally shielded from aboveground interference sources. Accordingly, the GPR signal is minimally affected by nearby aboveground conductive objects such as metal fences, overhead power lines, and vehicles.

A GPR survey is performed by towing an antenna across the ground along predetermined transect lines. The antennae is either pulled by a person or towed behind a vehicle. Preliminary GPR transects are performed over random areas of the site to calibrate the GPR equipment and characterize overall site conditions. The optimum time range settings are selected to provide the best combination of depth of investigation and data resolution for the subsurface conditions at the site. Ideally, the survey is performed along a pre-selected system of perpendicular or parallel transect lines. The configuration of the transect lines is designed based on the geometry and size of the target and the dimensions of the site. The beginning and ending points of the transect lines and grid intersection points, or nodes, are marked on the ground with spray paint or survey flags. A grid system is used to increase the probability of crossing the short axis of a target providing a more definitive signature in the data. The location of the antenna along a transect line is electronically marked on the cross section at each grid intersection point to allow correlation of the data to actual ground locations. The location of the targets can be marked on the ground surface using spray paint or survey flags.

### **Acoustic Location Methods**

Acoustic location methods generally apply to waterlines. A highly sensitive Acoustic Receiver listens for background sounds of water flowing; (at joints, leaks, etc.) or to sounds introduced into the water main using a transducer. This method may have good identification results, but can be inaccurate. Acoustics can also be utilized to determine the location of plastic gas lines.

## **FLD 38 HAND AND POWER HAND TOOLS**

### **REFERENCES**

29 CFR 1926 Subpart I

29 CFR 1910 Subpart P

ANSI Standard A10.3-1970, Safety Requirements for Explosive-Actuated Fastening Tools

### **RELATED FLDs**

*FLD 06 – Cold Stress*

*FLD 10 – Manual Lifting and Handling of Heavy Objects*

*FLD 16 – Pressure Systems: Compressed Gas Systems*

*FLD 35 – Electrical Safety*

### **INTRODUCTION**

Injuries from hand tools are often caused by improper use, using the wrong tool for the job, or from using a defective tool. Workers often assume that they know how to use a common hand tool. Working with something other than the simplest non-powered hand tools shall be performed only by those persons competent or qualified through formal training or documented experience.

Like all tools, hand and power tools must be maintained properly for effective use and safety. This Field Operating Procedure describes general safety guidelines for the four major categories of hand tools: cutting tools, torsion tools, impact tools, and power tools.

The use of any machinery, tool, material, or equipment which is not in compliance with any applicable OSHA 1910/1926 requirement is prohibited. Any tools or equipment identified as unsafe or defective will be “tagged or locked-out.” Controls shall be applied rendering the unsafe or defective tool or equipment inoperable. Any damaged or defective equipment shall be removed from its place of operation. Weston shall be responsible for the safe condition of tools and equipment used by employees, including tools and equipment that may be furnished by employees.

Tags shall be used as a means to prevent accidental injury or illness to employees who are exposed to hazardous or potentially hazardous conditions, equipment or operations, which are out of the ordinary, unexpected, or not readily apparent. Tags shall be used until the identified hazard is eliminated or the hazardous operation is completed. Tags need not be used where signs, guarding, or other positive means of protection are being used.

### **GENERAL SAFETY RULES – APPLICABLE TO USE OF ALL TOOLS**

- Tools will be inspected prior to each use. Tools found to be unsafe will be tagged by the inspector “Do Not Use” and either repaired or removed from the site.
- Keep the work area clear of clutter.
- Keep the work area properly illuminated.
- Maintain and keep tools sharpened, oiled, and stored in a safe, dry place.
- Wear ear and eye protection when cutting, sawing, drilling, or grinding.
- Supervisor should instruct everyone using equipment on safe procedures before they use them.
- Inspect tools, cords, and accessories regularly and document any repairs.

- Repair or replace problem equipment immediately.
- Electric power tools must have a 3-wire cord plugged into a grounded receptacle, be double-insulated or powered by a low-voltage isolation transformer, and fitted with guards and safety switches.
- Machine guards must be in-place and not removed during equipment operation.
- Do not alter factory-supplied safety features on tools.
- Install and repair equipment only if you are qualified.
- Use the right tool for the job; for instance, do not use a screwdriver as a chisel or a wrench as a hammer.
- Carry a sharp tool pointed downward or place in a tool belt or toolbox.
- Protect a sharp blade with a shield.
- Store tools in drawers or chests with cutting edge down.
- When using power tools, wear long hair in a protective manner, do not wear jewelry or loose clothing, use safety glasses, respiratory protection, hard hats, etc., as needed/specified by the manufacturer. Note that protective gloves should not be worn when operating powered woodworking tools because of the possibility of the work piece snagging the glove and pulling the hand to the cutting surface.
- All hand-held power-driven tools must be equipped with one of the following: a constant pressure switch that shuts off the power upon release (e.g., circular saws, hand-held power drills, chain saws) or an on-off switch (e.g., routers, planers scrolls saws, jigsaws).
- Never leave a running tool unattended.
- All workers using hand and power tools must be properly trained, and training must be documented.
- Tools of a non-sparking material must be used if fire/explosion hazards exist.
- All fuel-operated tools shall be stopped and allowed to cool prior to being refueled, serviced, or maintained, and proper ventilation provided when used in enclosed spaces.
- Bench grinders shall be properly grounded. Work rests must be kept at a distance not to exceed 1/8 inch from the grinding wheel surface.
- All persons using grinders or abrasive wheels shall use approved eye-protective devices.
- Hand held grinders shall have grinding wheel guards in place during operation.
- Train personnel to recognize that tasks involving lifting, repetitive motion, excess pressure, vibration, awkward positions, and remaining stationary for prolonged periods and work in cold conditions increase the risk of musculoskeletal injury. Procedures for avoiding or minimizing risk include: using mechanical devices for lifting, following procedures in FLD 10 when manual lifting is necessary, using shock absorbing gloves when using vibrating tools, choosing tools that reduce gripping force and align joints in a neutral position or holding tools in an ergonomically neutral position, taking breaks or alternating repetitive jobs, and following procedures in FLD 06.
- Hand tools such as chisels and punches, which develop mushroomed heads during use must be taken out of service and reconditioned by qualified persons or replaced, as necessary.
- Broken or fractured handles on hammers, axes and similar equipment must be replaced promptly.
- Worn or bent wrenches must be replaced.

- Handles designed for use on files and similar tools must be used.
- Jacks must be checked periodically to ensure they are in good operating condition

## **TORSION TOOLS**

Torsion tools are used to grip, fasten, and turn. These include wrenches, pliers, screwdrivers, vises, and clamps. There is a variety of each type of these tools. Selection is very important. Here are a few safety precautions for common torsion tools:

- Wrenches should always be pulled and not pushed. Pushing a wrench can cause a loss of control if there is a sudden release of pressure. A short, steady pull should be used rather than quick, jerky motions. Where available, use a socket wrench instead of an adjustable or open-ended wrench. Socket wrenches are generally easier to control, are more convenient, and are less likely to damage a bolt or nut. When using an adjustable wrench, the pressure should be applied to the fixed jaw
- Pipe wrenches can easily slip on pipes or fittings, causing injury. To prevent slipping, make sure that the pipe or fitting is clean and the wrench jaws are sharp and kept clean of oil and debris.
- Pliers should never be substituted for a wrench. They do not have the same gripping power and can easily slip on a tight object. When using cutting pliers, the object being cut can fly off and cause injury. Wear safety glasses when cutting with pliers.
- Screwdrivers are often misused. They should not be used for prying, or as punches or wedges. These misuses can damage the head of the screwdriver. A dull tip can cause the screwdriver to slip. The tip must be flat at the tip and tapered for a snug fit on the screw.
- When using vises, make sure that the vise is bolted solidly to a base (e.g., work bench). When cutting material in a vise, try to cut as close to the vise as possible to minimize vibration.
- Oil vises regularly.

## **Screwdrivers**

- Most screwdrivers are not designed to be used on electrical equipment. Use an insulated screwdriver.
- Do not hold an object in the palm of one hand and press a screwdriver into it; place the object on a bench or a table.
- Never hammer with a screwdriver.
- Check for broken handles, bent blade, etc.
- Select a screwdriver of the proper size to fit the screw.
- Screwdrivers with a split or splintered handle shall not be used.
- The point shall be kept in proper shape with a file or grinding wheel.
- Screwdrivers shall not be used as a substitute punch, chisel, nail-puller, etc.

## **Pliers**

- Do not use pliers as a substitute for hammers or wrenches.
- Use insulated pliers when doing electrical work.



- Inspect pliers frequently to make certain that they are free of breaks or cracks.
- Pliers shall be kept free from grease and oil and- the teeth or cutting edges shall be kept clean and sharp.
- The fulcrum pin, rivet or bolt shall be snug but not tight.

## **Wrenches**

- Select the correct size of wrench for the job.
- Never use a piece of pipe or another wrench as a wrench handle extension.
- Too much leverage can ruin a tool and cause injury.
- To avoid sudden slips, stand in a balanced position and always pull on the wrench instead of pushing against the fixed jaw.
- Only wrenches in good condition shall be used; a bent wrench, if straightened, has been weakened and shall not be used.
- Watch for sprung jaws on adjustable wrenches.
- Always pull toward yourself, never push, since it is easier to brace against a sudden lunge toward you should the tool slip or break.
- When using a wrench on a tight nut - first use some penetrating oil, use the largest wrench available that fits the nut, when possible pull on the wrench handle rather than pushing, and when possible apply force to the wrench with both hands while both feet are firmly placed. Always assume that you may lose your footing - check the place where you may fall for sharp objects.
- Keep all pipe wrenches clean and in good repair. The jaws of pipe wrenches should be wire brushed frequently to prevent an accumulation of dirt and grease that would otherwise build up and cause wrenches to slip.
- Never use pipe wrenches in place of a rod holding device.
- Replace hook and heel jaws when they become visibly worn.
- Position your hands so that your fingers will not be smashed between the wrench handle and the ground or other work surface; when breaking joints the wrench may slip or the joint may suddenly let go.

## **IMPACT TOOLS**

Impact tools include various types of hammers such as riveting hammers, carpenter's claw hammers, and sledgehammers. The main hazard associated with all these tools is damage to the hands and arms. The following safety procedures should be employed when using hammers:

- The handle shall be securely fitted and suited for the type of job and type of hammerhead. The striking face of the hammer shall be kept well dressed according to the application.
- The handle shall be smooth and free of oil to prevent slippage.
- Safety goggles shall be worn at all times when hammering to protect from flying nails, wood chips, and metal or plastic fragments.

- To properly drive a nail, hold the hammer near the end of the handle and start off with a light blow. Increase power after the nail is set.
- To avoid chipping or spalling of the hammerhead, use the lightest swing possible, hammer straight and not on an angle. Inspect the head of the hammer for potential chipping and spalling.

## **Hammers**

- Use the correct hammer for the type of work to be done.
- Have an unobstructed swing when using a hammer and watch for overhead interference.
- Check for defects before using.
- The head of a hammer shall be wedged securely and squarely on the handle and neither the head nor the handle shall be chipped or broken.

## **CUTTING TOOLS**

The main hazard associated with cutting tools is tool slippage. A dull tool or poor tool technique can cause a slip, which can redirect the cutting part of the tool toward the body. In addition, a sudden release or change in the force applied to a tool can throw the user off balance, possibly falling into another object, which may cause injury. To prevent slippage, tools shall be kept sharp and handled in such a way that, if a slip occurs, the direction of force will be away from the body. In addition, cutting along the grain of a material can help prevent changes in the pressure applied to the tool, thereby preventing slippage.

## **Chisels**

- Always wear safety goggles or a face shield when using a chisel.
- Drive wood chisel outward and away from your body.
- Do not use chisels to pry.
- Keep edges sharp for most effective work and protect when not in use.

## **Knives**

- Always cut away from the body.
- Keep hands and body clear of the knife stroke.
- Use a locking blade knife when possible.
- Keep blades sharp.
  - Knives and other sharp or edged tools must be maintained in proper condition. A sharp edged tool, used properly, is safer than a dull or improperly maintained tool.
  - When not in immediate use edged tools must be properly secured via, sheathing, closing, capping or covering.
  - Any task involving the use of an edged tool must be properly evaluated, alternatives to edged tools reviewed and training in the proper use, maintenance and handling verified by management and/or the site safety officer.
  - Knives, box cutters or like tools will not be authorized for cutting plastic wire ties or tubing. Use appropriately shaped and sized wire cutters or snips.
  - Remove knives from carry on luggage and place in checked baggage.

## **POWERED TOOLS**

- Portable power tools shall be carefully inspected before use and shall be kept repaired.
- Switches and plugs must operate properly, and the cords must be clean and free from defects.
- Portable powered tools capable of receiving guards and/or designed to accommodate guards shall be equipped with guards to prevent the operator from having any part of his body in the danger zone during the operating cycle.
- Electric powered portable tools with exposed conducting parts shall be grounded. Portable tools protected by an approved system of double insulation, or its equivalent, need not be grounded. Where such an approved system is employed, the equipment shall be distinctively marked.
- Hand-held powered tools of a hazardous nature such as circular saws having a blade diameter greater than two inches, chain saws, percussion tools, drills, tappers, fasteners, drivers, grinders with wheels greater than two inches in diameter, disc sanders, belt sanders, reciprocating saws, saber scroll saws and jig saws with blade shanks greater than one-fourth inch, and other similarly operating powered tools shall be equipped with a constant pressure switch or control ("dead-man switch") that will shut the power off when the pressure is released.
- Portable circular saws having a blade diameter over two inches shall be equipped with guards or hoods which will automatically adjust themselves to the work when the saw is in use, so that none of the teeth are exposed to contact above the work. When withdrawn from the work, the guard shall completely cover the saw to at least the depth of the teeth. The saw shall not be used without a shoe or guide.
- Pneumatic powered portable tools shall be equipped with automatic air shut-off valves that stop the tool when the operators hand is no longer in contact with the tool. Safety clips, retainers, or other effective means shall be installed on pneumatic tools to prevent the tools from accidentally misfiring.
- Abrasive wheels with a diameter of more than two inches shall be used only on machines provided with safety guards. The guards shall cover the spindle end, nut, and flange projections. Guards on operations where the work provides a suitable measure of protection to the operator may be so constructed that the spindle end, nut, and other flanges are exposed.
- Explosive-actuated fastening tools' muzzle ends shall have a protective shield or guard designed to confine any flying fragments or particles. The tool shall be so designed that it cannot be fired unless it is equipped with a protective shield or guard. Weston Solutions, Inc. employees are not permitted to use a power-actuated tool until properly trained as prescribed by the manufacturer.

### **Extension Cords**

See FLD 35, Electric Safety, for requirements and procedures for using extension cords.

## **SPECIALTY TOOLS**

### **Pneumatic Powered Tools**

Tools powered by air must be inspected and maintained as described above. Hose or tubing used to deliver air to pneumatic tools must be used as required and according to procedures in FLD 16, Pressure Systems: Compressed Gas Systems.

## **Powder-Actuated Tools**

- Only employees who have been trained in the operation of the particular tool in use shall be allowed to operate a powder-actuated tool.
- Powder-actuated tools shall be tested each day before loading to see that safety devices are in proper working condition. The method of testing shall be in accordance with the manufacturer's recommended procedure.
- Any tool found not in proper working order, or that develops a defect during use, shall be immediately removed from service and not used until properly repaired.
- Personal protective equipment shall be selected in accordance with manufacturer's recommendations and in consideration of the potential hazards of the task.
- Tools shall not be loaded until just prior to the intended firing time. Neither loaded nor empty tools are to be pointed at any employees. Hands shall be kept clear of the open barrel end.
- Loaded tools shall not be left unattended.
- Fasteners shall not be driven into very hard or brittle materials including, but not limited to, cast iron, glazed tile, surface-hardened steel, glass block, live rock, face brick, or hollow tile.
- Driving into materials easily penetrated shall be avoided unless such materials are backed by a substance that will prevent the pin or fastener from passing completely through and creating a flying missile hazard on the other side.
- No fastener shall be driven into a spalled area caused by an unsatisfactory fastening.
- Tools shall not be used in an explosive or flammable atmosphere.
- All tools shall be used with the correct shield, guard, or attachment recommended by the manufacturer.
- Powder-actuated tools used by employees shall meet all other applicable requirements of American National Standards Institute, A10.3-1970, Safety Requirements for Explosive-Actuated Fastening Tools.

## **RST 3 FLD 43A     ANIMALS**

Animals represent hazards because of their poisons or venoms, size and aggressiveness, diseases transmitted, or the insects they may carry.

### **Feral Animals**

Landfills and abandoned buildings often attract stray or abandoned dogs. These animals often become pack-oriented, very aggressive, and represent serious risk of harm to unprotected workers.

Workers entering abandoned buildings should be alert for such animals and avoid approaching them since this may provoke aggressive behavior. Avoidance and protection protocols include watching for animal dens, using good housekeeping, and using repellents.

### **Dangerous Wild Animals**

Work in remote areas inhabited by wild animals that have been known to cause injury and kill human beings, requires that companies working in these areas carefully plan for wildlife encounters. This FLD outlines actions that, when properly implemented, should provide a high degree of protection for WESTON employees and wildlife.

See Wildlife Hazard Recognition and Protection Procedure (Attached).

### **Venomous Snakes and Lizards**

#### Venomous Snakes

Venomous snakes are common around the world. The major variables are the likelihood of encounter and the snake that is likely to be encountered. Encounters with snakes may be caused by moving containers, reaching into holes, or just walking through high grass, swampy areas, or rocks. **Do not attempt to catch any snakes.**

Symptom of venomous snake bites:

- Bloody wound discharge, blurred vision, burning, convulsions, diarrhea, dizziness, excessive sweating, fainting, fang marks in the skin, fever, increased thirst, local tissue death, loss of muscle coordination, nausea and vomiting, numbness and tingling, rapid pulse, severe pain, skin discoloration, swelling at the site of the bite, weakness.

Venom from venomous snakes and lizards can be divided into three types of toxins, however, there are some indications that snake venom may have more than one toxin and characteristics may change as a snake ages. The three types of toxins and their effects are:

**Hemotoxins** destroy blood cells and affect the circulatory system. The site of the bite rapidly becomes swollen, discolored, and painful. This is usually accompanied by swelling, discoloration, and pain progressing toward the heart.

**Neurotoxins** affect the nervous system and symptoms vary from foggy vision, dizziness, and other comparatively mild symptoms to rigid or flaccid paralysis, shortness of breath, weakness or paralysis of the lower limbs, double vision, inability to speak or swallow, drooping eyelids, and involuntary tremors of the facial muscles. Death can occur in as little as ten minutes, usually due to abrupt cessation of respiration.

**Myotoxins** destroy cells and cause muscle necrosis.

In the US, with the exception of the coral snakes which tend to have neuron-toxic venom, most venomous snakes have been categorized as having hemotoxic venom (in some areas Mojave rattlesnakes are found to have neuron-toxic venom). There is some indication that some species of rattlesnakes have both hemotoxic and neuron-toxic venom. It is also reported that venom of younger snakes may be more neuron-toxic

There are many highly venomous snakes worldwide, some are deadly and most can be deadly without proper care.

## **Geographical Listing of Venomous Snakes**

Following is a list of poisonous snakes by geographic area. This list is extensive but may not be all inclusive. In planning for work around the world, also contact local agencies to determine whether there may be additional venomous snakes or lizards.

### **North America**

**Copperheads** (Broad-banded, Northern, Osage, Southern, Trans-Pecos)

**Rattlesnakes** Diamondback (eastern and western), Massasauga (eastern and western)

**Cottonmouth or water moccasin** (Eastern)

### **Prevention of Bites**

Key factors to working safely in areas where snakes or lizards may be encountered include:

- Be alert
- Use care when reaching into or moving containers
- Use sticks or long-handled tools when reaching where you cannot see
- Be familiar with the habits and habitats of snakes in the vicinity of an incident or site
- In areas or activities where encounters with snakes are likely, wear sturdy leather or rubber work boots and snake chaps
- Do not attempt to catch snakes unless required and qualified

A snake bite warrants medical attention after administration of proper first-aid procedures. It is important to contact local medical facilities to determine where anti-venoms are located.

## **First-Aid**

1. Keep the person calm. Restrict movement, and keep the affected area below heart level to reduce the flow of venom.
2. Remove any rings or constricting items because the affected area may swell. Create a loose splint to help restrict movement of the area.
3. If the area of the bite begins to swell and change color, the snake was probably venomous.
4. Monitor the person's vital signs -- temperature, pulse, rate of breathing, and blood pressure if possible. If there are signs of shock (such as paleness), lay the person flat, raise the feet about a foot, and cover the person with a blanket.
5. Get medical help immediately.
6. Try to photograph or identify the snake. Do not waste time hunting for the snake, and do not risk another bite. Be careful of the head of a dead snake. A snake can actually bite for up to an hour after it is dead (from a reflex).
  - DO NOT allow the person to become over-exerted. If necessary, carry the person to safety.
  - DO NOT apply a tourniquet.
  - DO NOT apply cold compresses to a snake bite.
  - DO NOT cut into a snake bite with a knife or razor.
  - DO NOT try to suction the venom by mouth.
  - DO NOT give stimulants or pain medications unless instructed to do so by a doctor.
  - DO NOT give the person anything by mouth.
  - DO NOT raise the site of the bite above the level of the person's heart
  - Transport the victim to medical attention immediately

## **Animal Borne Diseases**

### **Rabies**

Animal borne diseases include rabies (generally found in dogs, skunks, raccoons, bats, and foxes). Rabies varies from area to area as do the animals most likely to be rabid.

### **Questions and Answers about Rabies**

*Q. What is Rabies and how is it transmitted?*

A. Rabies is a viral infection most often transmitted by bites of animals infected with the virus.

*Q. What animals are most likely to be infected?*

A. Skunks, raccoons, foxes, and bats are wild animals most frequently found to be infected with rabies; however, any warm blooded animal can be infected. Squirrels, groundhogs, horses, cattle, and rabbits have been tested positive for rabies. Dogs and cats are frequently rabies-infected if not immunized.

*Q. How can you tell if an animal is rabies-infected?*

A. Rabies infection is not always apparent. Signs to look for in wild animals are over-aggressiveness or passivity. Spotting animals which are normally nocturnal (active at night) during the day and being able to approach them would be an example of unusual behavior. Finding a bat alive and on the ground is abnormal. The best precaution, however, is to observe wild animals from a safe distance, even if they are injured. Avoid dogs and cats that you do not know.

*Q. What should you do if bitten by an animal you suspect is infected with rabies?*

A. As quickly as possible, wash the bite area with soap and water, then disinfect with 70% alcohol and seek medical attention for follow-up. Try to capture the animal. Avoid being bitten again or contacting the mouth or any saliva of the animal. Keep the animal under surveillance and call the police for assistance to capture it. Have the animal tested.

A dead animal believed to be infected should be preserved and tested for rabies. Health departments are often sources where information can be found regarding testing.

*Q. Is there a cure for rabies?*

A. Rabies is preventable, even after being bitten, if treatment is begun soon enough. Getting prompt medical attention and confirming the rabies infection of an animal are very important. **Rabies is not curable once symptoms or signs of rabies appear.**

There are vaccines available that should be considered if a work assignment involves trapping animals likely to carry rabies. Medical consultants must be involved in decisions to immunize workers against rabies.

## **Hantavirus**

WESTON employees or contractors/subcontractors conducting field work in areas where there is evidence of a rodent population should be aware of an increased level of concern regarding the transmission of “Hantavirus”-associated diseases. Hantavirus is associated with rodents, especially the deer mouse (*Peromyscus maniculans*) as a primary reservoir host. Hantavirus has resulted in several deaths in the U.S.

The Hantavirus can be transmitted by infected rodents through their saliva, urine, and feces. Human infection may occur when infected wastes are inhaled as a result of aerosols produced directly from the animals. They also may come from dried materials introduced into broken skin or onto mucous membranes. Infections in humans occur most in adults and are associated with



activities that provide contact with infected rodents in rural/semi-rural areas. Hantavirus begins with one or more flu-like symptoms (i.e., fever, muscle aches, headache, and/or cough) and progresses rapidly to severe lung disease. Early diagnosis and treatment are vital.

## **Prevention**

Personnel involved in work areas where rodents and the presence of the Hantavirus are known or suspected will need to take personal protective measures and to develop an expanded site safety plan.

Field personnel involved in trapping or contacting rodents or their waste products will need to wear respirators with high-efficiency particulate air (HEPA) filters, eye protection, Tyvek coveralls, chemical-resistant gloves, and disposable boot covers. Strict decontamination requirements are needed. Double-bag, label, and specific handling, packaging, shipping, storage, and analytical procedures are required to minimize the risks of exposure from collected mice. More detailed procedures can be obtained from WESTON Corporate Health and Safety.

For employees and facilities in rural/semi-rural areas, the following risk-reduction strategies are appropriate:

- Eliminate rodents and reduce availability of food sources and nesting sites used by rodents.
- Store trash/garbage in rodent-proof metal or thick plastic containers with tight lids.
- Cut all grass/underbrush in proximity to buildings.
- Prevent rodents from entering buildings (e.g., use steel wool, screen, etc., to eliminate openings).

## **Plague**

Described under Insects (Fleas)

## **Anthrax**

Anthrax is an acute infectious disease caused by the spore-forming bacterium *Bacillus anthracis*. Anthrax most commonly occurs in wild and domestic lower vertebrates (cattle, sheep, goats, and other herbivores), but it can also occur in humans when they are exposed to infected animals or tissue from infected animals.

Anthrax is most common in agricultural regions where it occurs in animals. When anthrax affects humans, it is usually due to an occupational exposure to infected animals or their products. Workers who are exposed to dead animals and animal products from other countries where anthrax is more common may become infected with *B. anthracis* (industrial anthrax). Anthrax in wild livestock has occurred in the U.S.

Anthrax infection can occur in three forms: cutaneous (skin), inhalation, and gastrointestinal. *B. anthracis* spores can live in the soil for many years, and humans can become infected with anthrax by handling products from infected animals or by inhaling anthrax spores from contaminated animal products. Anthrax can also be spread by eating undercooked meat from infected animals. It is rare to find infected animals in the U.S.

**Cutaneous:** Most (about 95%) anthrax infections occur when the bacterium enters a cut or abrasion on the skin, such as when handling contaminated wool, hides, leather, or hair products (especially goat hair) of infected animals. Skin infection begins as a raised itchy bump that resembles an insect bite but within 1-2 days develops into a vesicle and then a painless ulcer, usually 1-3 cm in diameter, with a characteristic black necrotic (dying) area in the center. Lymph glands in the adjacent area may swell. About 20% of untreated cases of cutaneous anthrax will result in death. Deaths are rare with appropriate antimicrobial therapy.

**Inhalation:** Initial symptoms may resemble a common cold. After several days, the symptoms may progress to severe breathing problems and shock. Inhalation anthrax is usually fatal.

**Intestinal:** The intestinal disease form of anthrax may follow the consumption of contaminated meat and is characterized by an acute inflammation of the intestinal tract. Initial signs of nausea, loss of appetite, vomiting, and fever are followed by abdominal pain, vomiting of blood, and severe diarrhea. Intestinal anthrax results in death in 25% to 60% of cases.

Anthrax is not known to spread from one person to another person. Communicability is not a concern in managing or visiting patients with inhalation anthrax.

## **Prevention**

In countries where anthrax is common and vaccination levels of animal herds are low, humans should avoid contact with livestock and animal products and avoid eating meat that has not been properly slaughtered and cooked. Also, an anthrax vaccine has been licensed for use in humans. The vaccine is reported to be 93% effective in protecting against anthrax.

Doctors can prescribe effective antibiotics. To be effective, treatment should be initiated early. If left untreated, the disease can be fatal.

Direct person-to-person spread of anthrax is extremely unlikely; however, a patient's clothing and body may be contaminated with anthrax spores. Effective decontamination of people can be accomplished by a thorough wash down with anti-microbe effective soap and water. Waste water should be treated with bleach or other anti-microbial agent. Effective decontamination of articles can be accomplished by boiling contaminated articles in water for 30 minutes or longer and using common disinfectants. Chlorine is effective in destroying spores and vegetative cells on surfaces. Burning the clothing is also effective. After decontamination, there is no need to immunize, treat, or isolate contacts of people ill with anthrax unless they also were also exposed to the same source of infection. Early antibiotic treatment of anthrax is essential—delay seriously lessens chances for survival. Treatment for anthrax infection and other bacterial infections

includes large doses of intravenous and oral antibiotics, such as fluoroquinolones, like ciprofloxacin (cipro), doxycycline, erythromycin, vancomycin, or penicillin. In possible cases of inhalation anthrax exposure to unvaccinated personnel, early antibiotic prophylaxis treatment is crucial to prevent possible death.

No skin, especially if it has any wounds or scratches, should be exposed. Disposable personal protective equipment is preferable, but if not available, decontamination can be achieved by washing any exposed equipment in hot water, bleach and detergent. Disposable personal protective equipment and filters should be burned and buried. The size of *Bacillus anthracis* bacilli ranges from 0.5  $\mu\text{m}$  to 5.0  $\mu\text{m}$ . Anyone working with anthrax in a suspected or confirmed victim should wear respiratory equipment capable of filtering this size of particle or smaller. The U.S. National Institute for Occupational Safety and Health (NIOSH) and Mine Safety and Health Administration (MSHA) approved high efficiency-respirator, such as a half-face disposable respirator with a HEPA filter, is recommended. All possibly contaminated bedding or clothing should be isolated in double plastic bags and treated as possible bio-hazard waste. Dead victims that are opened and not burned provide an ideal source of anthrax spores; the victim should be sealed in an airtight body bag. Cremating victims is the preferred way of handling body disposal. No embalming or autopsy should be attempted without a fully equipped biohazard lab and trained and knowledgeable personnel.

Delays of only a few days may make the disease untreatable and treatment should be started even without symptoms if possible contamination or exposure is suspected. Animals with anthrax often just die without any apparent symptoms. Initial symptoms may resemble a common cold – sore throat, mild fever, muscle aches and malaise. After a few days, the symptoms may progress to severe breathing problems and shock and ultimately death. Death can occur from about two days to a month after exposure with deaths apparently peaking at about 8 days after exposure. [8] Antibiotic-resistant strains of anthrax are known.

Aerial spores can be trapped by a simple HEPA or P100 filter. Inhalation of anthrax spores can be prevented with a full-face mask using appropriate filtration. Unbroken skin can be decontaminated by washing with simple soap and water. All of these procedures do not kill the spores which are very hard to kill and require extensive treatment to eradicate them. Filters, clothes, etc. exposed to possible anthrax contaminated environments should be treated with chemicals or destroyed by fire to minimize the possibility of spreading the contamination.

In recent years there have been many attempts to develop new drugs against anthrax; but the existing supply still works fine if treatment is started soon enough.

Prevention can also be accomplished through early detection. In response to the U.S. Postal Service (USPS) anthrax attacks of October 2001, the USPS has installed BioDetection Systems (BDS) in their large-scale mail cancellation facilities. BDS response plans have been formulated by the USPS in conjunction with local responders including fire, police, hospitals, and public health. Employees of these facilities have been educated about anthrax, response actions and prophylactic medication. Because of the time delay inherent in getting final verification that anthrax has been used, prophylactic antibiotics for possibly exposed personnel should commence as soon as possible.

The ultimate in prevention is vaccination against infection but this has to be done well in advance of exposure.

Anthrax spores can survive for long periods of time in the environment after release. Methods for cleaning anthrax contaminated sites commonly use oxidizing agents such as peroxides, ethylene Oxide, Sandia Foam, chlorine dioxide (used in the Hart Senate office building), and liquid bleach products containing sodium hypochlorite. These agents slowly destroy bacterial spores. A bleach solution for treating hard surfaces has been approved by the EPA and can be prepared by mixing one part bleach (5.25%-6.00%) to one part white vinegar to eight parts water. Bleach and vinegar must not be combined together directly, rather some water must first be added to the bleach (e.g., two cups water to one cup of bleach), then vinegar (e.g., one cup), and then the rest of the water (e.g., six cups). The pH of the solution should be tested with a paper test strip; and treated surfaces must remain in contact with the bleach solution for 60 minutes (repeated applications will be necessary to keep the surfaces wet).

Chlorine dioxide has emerged as the preferred biocide against anthrax-contaminated sites, having been employed in the treatment of numerous government buildings over the past decade. Its chief drawback is the need for in situ processes to have the reactant on demand.

To speed the process, trace amounts of a non-toxic catalyst composed of iron and tetra-amido macrocyclic ligands are combined with sodium carbonate and bicarbonate and converted into a spray. The spray formula is applied to an infested area and is followed by another spray containing tertiary-butyl hydroperoxide

Using the catalyst method, a complete destruction of all anthrax spores takes 30 minutes. A standard catalyst-free spray destroys fewer than half the spores in the same amount of time. They can be heated, exposed to the harshest chemicals, and they do not easily die.

## **Brucellosis**

Brucellosis, also called undulant fever or Malta fever, is a zoonosis (infectious disease transmitted from animals to humans) caused by bacteria of the genus *Brucella*. It is primarily a disease of domestic animals (goats, pigs, cattle, dogs, etc.) and humans and has a worldwide distribution.

Although brucellosis can be found worldwide, it is more common in countries that do not have good standardized and effective public health and domestic animal health programs. Areas currently listed as high risk include the Caribbean.

The disease is transmitted either through contaminated or untreated milk (and its derivatives) or through direct contact with infected animals, which may include dogs, pigs, camels, and ruminants, primarily sheep, goats, cattle, and bison. This also includes contact with their carcasses.

Leftovers from parturition are also extremely rich in highly virulent brucellae. Brucellae, along with leptospira have the unique property of being able to penetrate through intact human skin, so infection by mere hand contact with infectious material is likely to occur.

The disease is now usually associated with the consumption of un-pasteurized milk and soft cheeses made from the milk of infected animals and with occupational exposure of veterinarians and slaughterhouse workers. Some vaccines used in livestock, most notably *B. abortus* strain 19 also cause disease in humans if accidentally injected. Problems with vaccine induced cases in the United States declined after the release of the RB-51 strain developed in the 1990s and the relaxation of laws requiring vaccination of cattle in many states.

The incubation period of brucellosis is, usually, of one to three weeks, but some rare instances may take several months to surface.

Brucellosis induces inconstant fevers, sweating, weakness, anemia, headaches, depression and muscular and bodily pain.

The symptoms are like those associated with many other febrile diseases, but with emphasis on muscular pain and sweating. The duration of the disease can vary from a few weeks to many months or even years. In first stage of the disease, septicaemia occurs and leads to the classic triad of undulant fevers, sweating (often with characteristic smell, likened to wet hay) and migratory arthralgia and myalgia.

## **Prevention**

The main way of preventing brucellosis is by using fastidious hygiene in producing raw milk products, or by pasteurization of all milk that is to be ingested by human beings, either in its pure form or as a derivate, such as cheese.

Provide protection from skin contact when handling potentially infected animals.

## **Q fever**

**Q fever** is caused by infection with *Coxiella burnetii*. This organism is uncommon but may be found in cattle, sheep, goats and other domestic mammals, including cats and dogs. The infection results from inhalation of contaminated particles in the air, and from contact with the vaginal mucus, milk, feces, urine or semen of infected animals. The incubation period is 9-40 days. It is considered possibly the most infectious disease in the world, as a human being can be infected by a single bacterium.

The most common manifestation is flu-like symptoms with abrupt onset of fever, malaise, profuse perspiration, severe headache, myalgia (muscle pain), joint pain, loss of appetite, upper respiratory problems, dry cough, pleuritic pain, chills, confusion and gastro-intestinal symptoms such as nausea, vomiting and diarrhea. The fever lasts approximately 7-14 days.

During the course, the disease can progress to an atypical pneumonia, which can result in a life threatening acute respiratory distress syndrome (ARDS), whereby such symptoms usually occur during the first 4-5 days of infection.

Less often the Q fever causes (granulomatous) hepatitis which becomes symptomatic with malaise, fever, liver enlargement (hepatomegaly), pain in the right upper quadrant of the abdomen and jaundice (icterus).

The chronic form of the Q fever is virtually identical with the inflammation of the inner lining of the heart (endocarditis), which can occur after months or decades following the infection. It is usually deadly if untreated. However, with appropriate treatment this lethality is around 10%.

The common way of infection is inhalation of contaminated dust, contact with contaminated milk, meat, wool and particularly birthing products. Ticks can transfer the pathogenic agent to other animals. Transfer between humans seems extremely rare and has so far been described in very few cases.

## **Prevention**

Q fever is effectively prevented by intradermal vaccination with a vaccine composed of killed *Coxiella burnetii* organisms. Skin and blood tests should be done before vaccination to identify preexisting immunity; the reason is that vaccinating subjects who already have immunity can result in a severe local reaction. After a single dose of vaccine, protective immunity lasts for many years. Revaccination is not generally required. Annual screening is typically recommended.

Wear appropriate PPE when handling potentially infected animals or materials.

## **Leptospirosis**

Leptospirosis is a bacterial disease that affects humans and animals. It is caused by bacteria of the genus *Leptospira*.

The time between a person's exposure to a contaminated source and becoming sick is 2 days to 4 weeks. Illness usually begins abruptly with fever and other symptoms. Leptospirosis may occur in two phases; after the first phase, with fever, chills, headache, muscle aches, vomiting, or diarrhea, the patient may recover for a time but become ill again. If a second phase occurs, it is more severe; the person may have kidney or liver failure or meningitis. This phase is also called Weil's disease.

The illness lasts from a few days to 3 weeks or longer. Without treatment, recovery may take several months. In rare cases death occurs.

Many of these symptoms can be mistaken for other diseases. Leptospirosis is confirmed by laboratory testing of a blood or urine sample.

*Leptospira* organisms have been found in cattle, pigs, horses, dogs, rodents, and wild animals. Humans become infected through contact with water, food, or soil containing waste from these infected animals. This may happen by consuming contaminated food or water or through skin contact, especially with mucosal surfaces, such as the eyes or nose, or with broken skin. The disease is not known to be spread from person to person.

Leptospirosis occurs worldwide but is most common in temperate or tropical climates. It is an occupational hazard for many people who work outdoors or with animals, for example, farmers, sewer workers, veterinarians, fish workers, dairy farmers, or military personnel. It is a recreational hazard for campers or those who participate in outdoor sports in contaminated areas and has been associated with swimming, wading, and whitewater rafting in contaminated lakes and rivers. The incidence is also increasing among urban children.

The risk of acquiring leptospirosis can be greatly reduced by not swimming or wading in water that might be contaminated with animal urine.

Protective clothing or footwear should be worn by those exposed to contaminated water or soil because of their job or recreational activities.

## **Prevention**

Avoid risky foods and drinks.

Buy it bottled or bring it to a rolling boil for 1 minute before drink it. Bottled carbonated water is safer than non-carbonated water.

Ask for drinks without ice unless the ice is made from bottled or boiled water. Avoid popsicles and flavored ices that may have been made with contaminated water.

Eat foods that have been thoroughly cooked and that are still hot and steaming

Avoid raw vegetables and fruits that cannot be peeled. Vegetables like lettuce are easily contaminated and are very hard to wash well. When eating raw fruit or vegetables that can be peeled, peel them yourself. (Wash your hands with soap first.) Do not eat the peelings.

Avoid foods and beverages from street vendors. It is difficult for food to be kept clean on the street, and many travelers get sick from food bought from street vendors.

Leptospirosis is treated with antibiotics, such as doxycycline or penicillin, which should be given early in the course of the disease. Intravenous antibiotics may be required for persons with more severe symptoms. Persons with symptoms suggestive of leptospirosis should contact a health care provider.

## **Ebola**

Ebola is both the common term used to describe a group of viruses belonging to genus Ebolavirus, family Filoviridae, and the common name for the disease which they cause, Ebola hemorrhagic fever. Ebola viruses are morphologically similar to the Marburg virus, also in the family Filoviridae, and share similar disease symptoms. Ebola has caused a number of serious and highly publicized outbreaks since its discovery.

Despite considerable effort by the World Health Organization, no animal reservoir capable of sustaining the virus between outbreaks has been identified. However, it has been hypothesized that the most likely candidate is the fruit bat.

Ebola hemorrhagic fever is potentially lethal and encompasses a range of symptoms including fever, vomiting, diarrhea, generalized pain or malaise, and sometimes internal and external bleeding. Mortality rates are extremely high, with the human case-fatality rate ranging from 50% - 89%, according to viral subtype. <sup>[2]</sup> The cause of death is usually due to hypovolemic shock or organ failure.

Because Ebola is potentially lethal and since no approved vaccine or treatment is available, Ebola is classified as a biosafety level 4 agent, as well as a Category A bioterrorism agent by the Centers for Disease Control and Prevention.

Symptoms are varied and often appear suddenly. Initial symptoms include high fever (at least 38.8°C), severe headache, muscle joint, or abdominal pain, severe weakness and exhaustion, sore throat, nausea, and dizziness. Before an outbreak is suspected, these early symptoms are easily mistaken for malaria, typhoid fever, dysentery, influenza, or various bacterial infections, which are all far more common and less reliably fatal.

Ebola may progress to cause more serious symptoms, such as diarrhea, dark or bloody feces, vomiting blood, red eyes due to distention and hemorrhage of sclerotic arterioles, petechia, maculopapular rash, and purpura. Other secondary symptoms include hypotension (less than 90 mm Hg systolic /60 mm Hg diastolic), hypovolemia, tachycardia, organ damage (especially the kidneys, spleen, and liver) as a result of disseminated systemic necrosis, and proteinuria. The interior bleeding is caused by a chemical reaction between the virus and the platelets which creates a chemical that will cut cell sized holes into the capillary walls.

Among humans, the virus is transmitted by direct contact with infected body fluids, or to a lesser extent, skin or mucus membrane contact. The incubation period can be anywhere from 2 to 21 days, but is generally between 5 and 10 days.

Although airborne transmission between monkeys has been demonstrated by an accidental outbreak in a laboratory located in Virginia, USA, there is very limited evidence for human-to-human airborne transmission in any reported epidemics.

The infection of human cases with Ebola virus has been documented through the handling of infected chimpanzees, and gorillas--both dead and alive.



So far, all epidemics of Ebola have occurred in sub-optimal hospital conditions, where practices of basic hygiene and sanitation are often either luxuries or unknown to caretakers and where disposable needles and autoclaves are unavailable or too expensive. In modern hospitals with disposable needles and knowledge of basic hygiene and barrier nursing techniques, Ebola rarely spreads on such a large scale.

## **Prevention**

Prevention methods include good hygiene in medical settings and awareness of the virus in travel areas. There is no known effective vaccine for humans.

Prevention efforts should concentrate on avoiding contact with host or vector species. Travelers should not visit locations where an outbreak is occurring. Contact with rodents should be avoided. Minimize exposure to arthropod bites by using permethrin-impregnated bed nets and insect repellents.

Strict compliance with infection control precautions (i.e., use of disposable gloves, face shields, and disposable gowns to prevent direct contact with body fluids and splashes to mucous membranes when caring for patients or handling clinical specimens; appropriate use and disposal of sharp instruments; hand washing and use of disinfectants) is recommended to avoid health care-associated infections.

Contact with dead primates should be avoided.

## **Bird and Bat Borne or Enhanced Diseases**

**See also under Molds and Fungus**

## **Histoplasmosis**

Histoplasmosis is a fungal infection which enters the body through the lungs. The infection enters the body through the lungs. The fungus grows as a mold in the soil, and infection results from breathing in airborne particles. Soil contaminated with bird or bat droppings are known to have a higher concentration of histoplasmosis.

There may be a short period of active infection, or it can become chronic and spread throughout the body. Most people who do develop symptoms will have a flu-like syndrome (acute-fever, chills cough, and chest pain; chronic-chest pain, cough with blood, fever, shortness of breath, sweating) and lung complaints related to pneumonia or other lung involvement. Approximately 10% of the population will develop inflammation in response to the initial infection. This can effect the skin, bones or joints, or the lining of the heart (pericardium). These symptoms are not due to fungal infection of those body parts, but due to inflammation.

In a small number of patients, histoplasmosis may become widespread (disseminated) in involve the blood, brain, adrenal glands, or other organs. Very young or old are at a higher risk for

disseminated histoplasmosis. Symptoms include fevers, headache, neck stiffness, mouth sores, skin lesions.

Histoplasmosis may be prevented by reducing dust exposure in areas containing bird or bat droppings. Wear PPE and respirator when working within this environment. Institute work practices and dust control measures, i.e. moist/wet area, that eliminate or reduce dust generation which will reduce risks of infection and subsequent development of disease.

## Treatment

The main treatment for histoplasmosis is antifungal drugs. Amphotericin B, itraconazole, and ketoconazole are the usual treatments. Long-term treatment with antifungal drugs may be needed.

## Psittacosis

Psittacosis is a disease caused by a bacteria that is found in bird droppings and other secretions (often carried by pet birds). The bacteria is found worldwide.

Symptoms of psittacosis infection may include a low-grade fever that often becomes worse as the disease progresses, including anorexia, sore throat, light sensitivity, and a severe headache.

Ammonia and sodium hypochlorite based disinfectants are effective disinfectants for Psittacosis.

Where it is necessary to remove bat droppings from buildings prior to renovation or demolition it is prudent to assume infection and use the following precautions:

- Avoid areas that may harbor the bacteria, e.g., accumulations of bird or bat droppings.
- Areas known or suspected of being contaminated by *the organisms causing* Psittacosis such as bird roosts, attics, or even entire buildings that contain accumulations of bat or bird manure, should be posted with signs warning of the health risk. The building or area should be secured
- Before an activity is started that may disturb any material that might be contaminated by Psittacosis, workers should be informed in writing of the personal risk factors that increase an individual's chances of developing these diseases. Such a written communication should include a warning that individuals with weakened immune systems are at the greatest risk of developing severe forms of these diseases become infected. These people should seek advice from their health care provider about whether they should avoid exposure to materials that might be contaminated with these organisms.

The best way to prevent exposure is to avoid situations where material that might be contaminated can become aerosolized and subsequently inhaled. A brief inhalation exposure

highly contaminated dust may be all that is needed to cause infection and subsequent development of psittacosis. Therefore, work practices and dust control measures that eliminate or reduce dust generation during the removal of bat manure from a building will also reduce risks of infection and subsequent development of disease. For example, instead of shoveling or sweeping dry, dusty material, carefully wetting it with a water spray can reduce the amount of dust aerosolized during an activity. Adding a surfactant or wetting agent to the water might reduce further the amount of aerosolized dust.

Once the material is wetted, it can be collected in double, heavy-duty plastic bags, a 55-gallon drum, or some other secure container for immediate disposal. An alternative method is use of an industrial vacuum cleaner with a high-efficiency filter to *bag* contaminated material. Truck-mounted or trailer-mounted vacuum systems are recommended for buildings with large accumulations of bat or bird manure. These high-volume systems can remove tons of contaminated material in a short period. Using long, large-diameter hoses, such a system can also remove contaminated material located several stories above its waste hopper. This advantage eliminates the risk of dust exposure that can happen when bags tear accidentally or containers break during their transfer to the ground.

The removal of all material that might be contaminated from a building and immediate waste disposal will eliminate any further risk that someone might be exposed to aerosolized spores. Air sampling, surface sampling, or the use of any other method intended to confirm that no infectious agents remain following removal of bat manure is unnecessary in most cases. However, before a removal activity is considered finished, the cleaned area should be inspected visually to ensure that no residual dust or debris remains.

Spraying 1:10 bleach to water mixture on droppings and allowing it to dry is also a recommended practice for the psittacosis organisms.

Because work practices and dust control measures to reduce worker exposures to these organisms have not been fully evaluated, using personal protective equipment is still necessary during some activities. During removal of an accumulation of bat or bird manure from an enclosed area such as an attic, dust control measures should be used, but wearing a NIOSH-approved respirator and other items of personal protective equipment is also recommended to reduce further the risk of exposure to the organisms that cause Psittacosis.

## Treatment

Psittacosis is often hard to diagnoses and while a concern, it does not occur with great frequency. Knowledge of the symptoms and of potential exposure is important when seeking medical follow-up for potential exposure.

There are various medical treatments for psittacosis based on extent of infection. The sooner the disease is diagnosed and treatment is begun the more effective the treatment will be.

## **APPENDIX A**

### **Dangerous Animals - Wildlife Hazard Recognition and Protection**

#### **GENERAL**

Work in remote areas inhabited by wild animals that have been known to cause injury and kill human beings, requires that companies working in these areas carefully plan for wildlife encounters. This procedure outlines actions that when properly implemented should provide a high degree of protection for employees and wildlife.

These procedures apply to employees who prepare Health and Safety Plans or perform fieldwork in environments in which wild animals may be encountered. However, due to the unpredictable nature of wild animals this single document cannot possibly cover all potential risks or protective measures. Therefore, prior to entering remote areas inhabited by dangerous wildlife, contact local wildlife agencies to gather additional information concerning local risks and protective measures.

#### **ATTACHMENTS**

Attachments 1 and 2 outline behavioral characteristics of and outline controls that will minimize human injury, loss of property, and unnecessary destruction of wildlife, while ensuring a safe work environment.

#### **WILDLIFE AVOIDANCE AND BASIC PROTECTIVE MEASURES**

The best protective measure is simply avoidance. Large numbers of humans present deterrence to wild animals; therefore, whenever possible teams in the field should work together in groups of four or more. Whenever practical, fieldwork should be scheduled around the seasonal cycles of wildlife in the area. When wild animal avoidance cannot be achieved through scheduling, personnel involved in field activities in which encounters with wild animals may result, will take the following steps and will be equipped and trained, as set forth below.

#### **CLEAR THE AREA**

Evaluate and control the area before entry by

- Determine areas of recent sightings through local Fish and Game, state troopers, etc.;
- Conduct a site observation from an off-site elevated point, if possible;
- Conduct a controlled walk through in the area by a trained observer;
- Arrange a briefing by a local specialist, e. g., Fish and Game, etc.; and
- Utilizing appropriate noisemakers.

#### **BASIC EQUIPMENT**

Employees entering an environment where encounters with wild animals are possible should be provided, as a minimum:

- Noisemakers, such as air horns, bells, etc.; and
- Bear spray of not less than 16-ounce capacity (with holster), equivalent to capsicum pepper (red pepper extract), which is capable of spraying at least 15 feet. (Notes: Normally cannot be transported in side aircraft passenger compartments and may be

considered a hazardous material, check with airlines and hazardous material shippers for current information).

## **TRAINING**

Prior to entering and / or working in areas inhabited by dangerous wildlife each employee should receive training as outlined in this procedure. At a minimum, training must include information related to:

- Wildlife present, habitat, behavior patterns, including when wild animals are most active, etc.
- Warning signs, such as tracks, bedding areas, scat, claw marks, offspring, paths, etc.,
- Avoidance measures
- Other hazards, precautions, and protective measures as outlined in the Attachments,
- (At the jobsite) spray demonstration and safety instructions which include location of and persons designated as “bear watch”

An outline of the training content should be reviewed and approved by the Divisional EHS manager and should be documented. A record of the training will be maintained at the job site, filed with the SSHSP and in the employee’s training records.

## **VEHICLE SAFETY**

Use extreme caution, particularly in darkness, when operating vehicles in areas where wild animals may be present. Collisions with large animals have been known to cause significant property damage and personal injuries to vehicle passengers, including fatalities.

## **ATTACHMENT 1**

### **BEAR SAFETY – HAZARD RECOGNITION AND PRECAUTIONS**

On occasion fieldwork may be conducted in a location where bears may be encountered. The following technical information, precautions, and guidelines for operations in which bears could be encountered are based on experience and conditions for field work. Bears are intelligent, wild animals and are potentially dangerous, and would rather be left alone. The more bears are understood the less they will be feared. This attachment is intended to provide information that will enable Weston to plan for bear encounters and to properly address face-to-face encounters.

### **Bear Life History**

Although bears are creatures of habit, they are also intelligent, and each has its own personality. The way a bear reacts is often dictated by what it has learned from its mother, the experience it has had on its own, and the instincts nature has provided. Like other intelligent animals, we can make general statements about bears, but few people can accurately predict their behavior.

Bears have an incredible sense of smell, and seem to trust it more than any other sense. Hearing and sight are also important, but to a lesser degree. A bear's hearing is probably better than ours, but not as keen as a dog's hearing. Their sight is probably comparable to that of a human. Black bears tend to favor forested habitats.

Bears are opportunists, relying on their intelligence and their senses to find food. They use different habitats throughout the year, depending on the availability of food and other necessities. The area a bear covers in a given year is partially dependent on how far it has to go to satisfy these basic needs. In some areas, individual bears have home ranges of less than a square mile; in other areas ranges can encompass hundreds of square miles. Males usually range over larger areas than females.

In spring, bears begin coming out of hibernation. Males are usually the first bears to emerge, usually in April, and females with new cubs are usually the last, sometimes as late as late June. When bears emerge from their dens, they are lethargic for the first few days, frequently sleeping near their dens and not eating. When they do start eating, they seek carrion (deer, etc.), roots, and emerging vegetation. In coastal areas, beaches become travel corridors as bears seek these foods.

In early summer, bears eat new grasses and forage as they develop in higher elevations. In coastal areas, salmon are the most important food from June through September. This period is one of the few times that bears are found in large groups, and it is the time that most people see bears. Bears often travel, eat, and sleep along streams for weeks at a time.

Other summer foods for bears include grasses and ground squirrels. When bears kill or scavenge large prey, they commonly cover the portions they cannot eat with sticks and duff. A bear may remain near a food cache for days and it will defend it from intruders.

During the late summer and early fall, bears move inland and consume large amounts of blueberries, and other succulent fruits. As the seasons progress towards winter, a bear's diet becomes more varied. This is the time that bears are adding final deposits of fat before their long winter naps.

In October and November, bears move into their denning areas and begin preparing a suitable den. Black bears usually den in holes under large trees or rock outcrops, or in small natural cavities. Dens are just large enough for the bears to squeeze into. Bears rarely eat, drink, urinate, or defecate while they are denning. They sleep deeply, but do not truly hibernate, and they can be awakened by loud noises or disturbances.

Cubs are born in the den, usually in January. Black bear cubs usually stay with their mothers for a year and a half. Black bears are sexually mature at age 2. Mating season is in the spring (May or June) and both species are polygamous (multiple mates). Black bears can live for 25 – 30 years, although most live less than 20 years.

### **BEAR AND HUMAN INTERACTIONS**

Bears generally prefer to be left alone, but they share their homes with other creatures, including humans, who intrude on virtually every aspect of the bear's life. Bears are normally tolerant of these activities and generally find a secure way to avoid them. Humans can help bears make a graceful retreat and avoid many close encounters by letting them know we are coming. Walking in groups, talking, and wearing noise making devices, such as bear bells, all serve to warn a bear of your approach. When possible, avoid hiking and camping in areas where bears are common, such as bear trails through heavy brush or along salmon streams. Always keep an eye out for bears and bear signs. If you happen upon a dead animal, especially one that is covered with sticks and duff (a bear cache), immediately retreat the way you came, but do not run, and make a detour around the area. If you see a cub up a tree or a small bear walking alone, immediately retreat and detour around the area. Like all young animals, cubs wander away from their mothers, but females are furiously protective when they believe their cubs are threatened. Even if we do everything possible to avoid meeting a bear, sometimes bears come to us.

Bears are both intelligent and opportunistic, and they express these qualities through their curiosity. This curiosity frequently brings them into "human habitat." When this happens, we often feel vulnerable, and the bear is sometimes viewed as a threat or nuisance. In most cases, a curious bear will investigate a "human sign," perhaps test it out (chew on a raft, bite into some cans, etc.), and leave, never to return. If the bear was rewarded during his investigation by finding something to eat, it is hard to stop them from returning once they have had a food-reward. That is why we emphasize the importance of keeping human food and garbage away from bears. When in bear country, always think about the way you store, cook, and dispose of your food. **Never feed bears!** This is both illegal and foolish. Food should be stored in airtight containers, preferably away from living and sleeping areas. Garbage should be thoroughly incinerated as soon as possible. Fish and game should be cleaned well away from camp, and clothing that smells of fish and game should be stored away from sleeping areas. Menstruating women should take extra precautions to keep themselves as clean as possible, and soiled tampons and pads should

be treated as another form of organic garbage. Once a bear has obtained food from people, it may continue to frequent areas occupied by people. If a bear does not find food or garbage after the next few tries, it may give up and move back into a more natural feeding pattern. Occasionally, though, the bear will continue to seek human foods and can become a “problem bear.” Some bears become bold enough to raid campsites and break into cabins to search for human food. Shooting bears in the rump with cracker shells, flares, rubber bullets, and birdshot are common methods of “aversive conditioning.” These are also very dangerous techniques, because they may seriously injure a bear if not done properly and/or they may cause a bear to attack the shooter.

## **BLACK BEARS**

Black Bear Identification: Black bears are the smallest and most abundant of the bear species. They are five to six feet long and stand about two to three feet high at the shoulders. They weigh from 200 to 500 pounds. While they are most commonly black, other color phases include brown (cinnamon), and, rarely, gray (blue), and white. Muzzles are usually brown. Black bears can be distinguished from brown bears by:

- Their head shape (a black bear’s nose is straight in profile, a brown bear’s is dished);
- Their claws (black bear’s claws are curved and smaller, brown bears are relatively straight and longer);
- Their body shape (when standing, a black bear’s rump seems to be higher than its shoulders; a brown bear’s shoulders are usually higher than its rump); and

Typical Habitat: Black bears occupy a wide range of habitats, but seem to be most common in forested areas.

## **AVOIDING BEAR ENCOUNTERS WHEN**

- The Bear sees you but you do not know the bear is around: The bear will likely avoid detection people and will simply move away when they sense a human.
- You see a bear and it does not know you are there: Move away slowly. Avoid intercepting the bear if it is walking. If possible, detour around the bear. If the bear is close to you, stand where you are or back away slowly. Do not act threateningly toward the bear, it may know you are there but it has chosen to ignore you as long as you are not a threat.
- You see the bear and the bear sees you: Do not act threateningly, but let the bear know you are human. Wave your arms slowly, talk in a calm voice, and walk away slowly in a lateral direction, keeping an eye on the bear. Unless you are very close to a car or a building, never run from bears. In a bear’s world, when something runs it is an open invitation to chase it. Bears will chase a running object even if they have no previous intention of catching it. Bears can run as fast as a racehorse, so humans have little or no chance of outrunning a bear.
- You see a bear; the bear sees you and stands on its hind legs: This means that the bear is seeking more information. Bears stand on their hind legs to get a better look, or smell, at something they are uncertain of. It is your cue to help it figure



out what you are. Help the bear by waving your arms slowly and talking to it. Standing is not a precursor to an attack. Bears do not attack on their hind legs. It is also important to remember that when a bear goes back down on all fours from a standing position, it may come towards you a few steps. This is normal, and probably not an aggressive act.

- The bear sees you, recognizes you as a human, but continues to come towards you slowly: This may mean several things, depending on the bear and the situation. It may mean that the bear does not see you as a threat, and just wants to get by you (especially if the bear is used to humans, as in a National Park); the bear wants to get food from you (if it has gotten food from people before); the bear wants to test your dominance (it views you as another bear); or may be stalking you as food (more common with black bear, but a rare occurrence). In all cases, your reaction should be to back off the trail very slowly, stand abreast if you are in a group, talk loudly, and/or use a noise-making device. If the bear continues to advance, you should stop. At this point, it is important to give the bear the message that if he continues to advance it will cost him. Continue to make loud noises and present a large visual image to the bear (standing abreast, open your coat). In bear language, bears assert themselves by showing their size. If an adult brown bear continues to come at you, climbing 20 feet or higher up a tree may also be an option if one is next to you (remember, never run from bears). Keep in mind, though, black bears can climb trees.
- The bear recognizes you as a human and acts nervous or aggressive: When bears are nervous or stressed they can be extremely dangerous. This is when it is important to try to understand what is going on in the bears mind. Nervous bears growl, woof, make popping sounds with their teeth, rock back and forth on their front legs, and often stand sideways to their opponent. A universal sign of a nervous bear is excessive salivation (sometimes it looks like they have white lips). When a bear shows any of these signs, stand where you are and talk in a calm voice. Do not try to imitate bear sounds, this may only serve to confuse and further agitate the bear. If you are in a group, stand abreast.
- The bear charges: If all other signals fail, a bear will charge. Surprisingly, most bear charges are just another form of their language. The majority of these are “bluff charges,” that is; the bear stops before making contact with their opponent. There are many different types of bluff charges ranging from a loping uncertain gait to a full-blown charge. If a bear charges, stand still.
- The bear attacks: When all else fails, a bear may attack. Attacks may be preceded by all of the behaviors previously described or they may be sudden. Seemingly unprovoked attacks are often the result of a bear being surprised (and feeling threatened), a bear defending its food cache, or a female defending her cubs. When a bear attacks, it typically runs with its body low to the ground, legs are stiff, ears are flattened, hair on the nape of the neck is up, and the bear moves in a fast, determined way. Front paws are often used to knock the opponent down and jaws are used to subdue it.

## **AFTER A BEAR ENCOUNTER**

Black bears have been known to view humans as prey, and if you struggle with the attacking black bear, it will probably go elsewhere for its meal.

- Bear Sprays: Are easy to carry and use, little risk of permanent damage to bears and humans, effective in many situations. However, using a spray may change a false charge into a real charge, they are ineffective at ranges greater than 20 feet, ineffective in windy conditions, dangerous if accidentally discharged in a closed area such as an aircraft cockpit.

The most effective tool you have against an attacking bear is your brain. Although bears are intelligent animals, we are smarter and can often think our way out of a bad situation if we try.

## **ATTACHMENT 2**

### **HAZARDS AND PRECAUTIONS – DEER**

The following technical information, precautions, and guidelines for operations in which Deer may be encountered. The more the species are understood, the easier it will be to avoid contact with them thus preventing injury to ourselves and to the animals. All big game species are unpredictable and can be dangerous under certain conditions. This attachment is intended to provide information that will enable Weston to plan for encounters and to properly address face-to-face encounters.

### **WHITE-TAILED DEER**

The White-tailed deer found throughout the eastern and western part of the United States have been known to attack people on many occasions. It is unknown whether Black-tailed deer have made any such attacks, but it is possible for someone to be injured by an irate buck in the breeding season (late fall). Deer are well equipped to injure humans. They are very fast. Bucks have sharp antlers and can clear amazingly high obstacles with graceful, arching leaps. They can run with remarkable speed, even in dense cover, and have excellent camouflage. When working in areas populated with deer, it is just common sense not to approach any large wild animal too closely. It is unlikely that an attack from a deer would be fatal but it is possible and serious injury is likely.

## APPENDIX B - PICTURES OF POISONOUS SNAKES AND LIZARDS

### Americas



American copperhead



Cotton Mouth – East and Southeast US



Timber Rattlesnake – Eastern US

## **FLD 43 B     INSECTS**

### **Sting and Biting Insects**

Contact with stinging insects may result in site personnel experiencing adverse health affects that range from being mildly uncomfortable to being life threatening. Therefore, stinging insects present a serious hazard to site personnel and extreme caution must be exercised whenever site and weather conditions increase the risk of encountering stinging insects. These include the following:

- Bees (Honeybees, bumble bees, wasps, and hornets and wingless wasps)
- Scorpions
- Fire ants
- Spiders
- Ticks
- Deer Flies
- Mosquito
- Fleas
- Bed Bugs

### **Bees, Wasps, Hornets and Yellow Jackets**

The severity of an insect sting reaction varies from person to person. A normal reaction will result in pain, swelling and redness confined to the sting site. Simply disinfect the area (washing with soap and water will do) and apply ice to reduce the swelling.

A large local reaction will result in swelling that extends beyond the sting site. For example, a sting on the forearm could result in the entire arm swelling twice its normal size.

Although alarming in appearance, this condition is often treated the same as a normal reaction. An unusually painful or very large local reaction may need medical attention. Because this condition may persist for two to three days, antihistamines and corticosteroids are sometimes prescribed to lessen the discomfort.

Yellow jackets, hornets and wasps can sting repeatedly. Honeybees have barbed stingers that are left behind in their victim's skin. These stingers are best removed by a scraping action, rather than a pulling motion, which may actually squeeze more venom into the skin.

### **Scorpions (Caribbean)**

Scorpion stings are a major public health problem in many underdeveloped tropical countries. For every person killed by a poisonous snake, 10 are killed by a poisonous scorpion. In the United States, only 4 deaths in 11 years have occurred as a result of scorpion stings. Furthermore, scorpions can be found outside their normal range of distribution, ie, when they

accidentally crawl into luggage, boxes, containers, or shoes and are unwittingly transported home via human travelers.

Out of 1,500 scorpion species, 50 are dangerous to humans. Scorpion stings cause a wide range of conditions, from severe local skin reactions to neurologic, respiratory, and cardiovascular collapse.

Almost all of these lethal scorpions belong to the scorpion family called the Buthidae. The Buthidae are small to mid-size scorpions (0.8 inch to 5.0 inches) and normally uniformly colored without patterns or shapes. Poisonous scorpions also tend to have weak-looking pincers, thin bodies, and thick tails, as opposed to the strong heavy pincers, thick bodies, and thin tails seen in nonlethal scorpions. The lethal members of the Buthidae family include the genera of *Tityus* which can be found in the Caribbean.

A scorpion has a flattened elongated body and can easily hide in cracks. Scorpions are members of the Arachnid (spider) family. The bodies consist of 3-segments, they also have 4 pairs of legs, a pair of claws, and a segmented tail that has a poisonous spike at the end. Scorpions vary in size from 1-20 cm in length.

However, scorpions may be found outside their habitat range of distribution when inadvertently transported with luggage and cargo.

## **Prevention**

Preventive measures include awareness of scorpions, shaking out clothing and boots before putting them on looking before reaching into likely hiding places and wearing gloves, long sleeved shirts and pants.

## **Symptoms**

In mild cases, the only symptom may be a mild tingling or burning at site of sting.

In severe cases, symptoms may include:

- Eyes and ears - Double vision
- Lungs - Difficulty breathing, No breathing, Rapid breathing,
- Nose, mouth, and throat – Drooling, Spasm of the voice box, Thick-feeling tongue
- Heart and blood - High blood pressure, Increased or decreased heart rate, Irregular heartbeat
- Kidneys and bladder Urinary incontinence, Urine output, decreased
- Muscles and joints - Muscle spasms
- Nervous system – Paralysis, Random movements of head, eye, or neck, Restlessness, Seizures, Stiffness
- Stomach and intestinal tract - Abdominal cramps, Fecal incontinence
- Other -Convulsions

## **Treatment**

1. Recognize scorpion sting symptoms:
2. Wash the area with soap and water.
3. Apply a cool compress on the area of the scorpion sting. Ice (wrapped in a washcloth or other suitable covering) may be applied to the sting location for 10 minutes. Remove compress for 10 minutes and repeat as necessary.
4. Call the Poison Control Center. If you develop symptoms of a poisonous scorpion sting, go to the nearest emergency care facility.
5. Keep your tetanus shots and boosters current.

## **Fire Ants (Caribbean)**

Fire ants are aggressive, reddish-brown to black ants that are 1/8 inch to 1/4 inch long. They construct nests, which are often visible as dome-shaped mounds of soil, sometimes as large as 3 feet across and 1 1/2 feet in height. In sandy soils, mounds are flatter and less visible. Fire ants usually build mounds in sunny, open areas such as lawns, pastures, cultivated fields and meadows, but they are not restricted to these areas. Mounds or nests may be located in rotting logs, around trees and stumps, under pavement and buildings, and occasionally indoors.

Fire ants use their stingers to immobilize or kill prey and to defend ant mounds from disturbance by larger animals, such as humans. Any disturbance sends hundreds of workers out to attack anything that moves. The ant grabs its victim with its mandibles (mouthparts) and then inserts its stinger. The process of stinging releases a chemical, which alerts other ants, inducing them to sting. In addition, one ant can sting several times without letting go with its mandibles.

Once stung, humans experience a sharp pain that lasts a couple of minutes, then after a while the sting starts itching and a welt appears. Fire ant venom contains alkaloids and a relatively small amount of protein. The alkaloids kill skin cells; this attracts white blood cells, which form a pustule within a few hours of being stung. The fluid in the pustule is sterile, but if the pustule is broken, the wound may become infected. The protein in the venom can cause allergic reactions that may require medical attention.

Some of the factors related to stinging insects that increase the risk associated with accidental contact are:

- The nests for these insects are frequently found in remote wooded or grassy areas and hidden in cavities
- The nests can be situated in trees, rocks, bushes or in the ground, and are usually difficult to see
- Accidental contact with these insects is highly probable, especially during warm weather conditions when the insects are most active
- If a site worker accidentally disturbs a nest, the worker may be inflicted with multiple stings, causing extreme pain and swelling which can leave the worker incapacitated and in need of medical attention



- Some people are hypersensitive to the toxins injected by a sting, and when stung, experience a violent and immediate allergic reaction resulting in a life-threatening condition known as anaphylactic shock
- Anaphylactic shock manifests itself very rapidly and is characterized by extreme swelling of the body, eyes, face, mouth and respiratory passages
- The hypersensitivity needed to cause anaphylactic shock, can in some people, accumulate over time and exposure, therefore, even if someone has been stung previously, and not experienced an allergic reaction, there is no guarantee that they will not have an allergic reaction if they are stung again

With these things in mind, and with the high probability of contact with stinging insects, use the following safe work practices:

- If a worker knows that he is hypersensitive to bee, wasp or hornet stings, inform the site Safety officer of this condition prior to participation in site activities
- All site personnel will be watchful for the presence of stinging insects and their nests, and will advise the Site Safety officer if a stinging insect nest is located or suspected in the area
- Any nests located on site will be flagged off and site personnel will be notified of its presence
- If attacked, site personnel will immediately seek shelter and stay there. Do not jump in water (bees will still be in the area when you come up). Once safe, remove stings from your skin, it does not matter how you do it, but do it as quickly as possible to reduce the amount of venom they inject. Obtain first aid treatment and contact the safety officer who will observe for signs of allergic reaction

Treatment for fire ant stings is aimed at preventing secondary bacterial infection, which may occur if the pustule is scratched or broken. Clean the blisters with soap and water to prevent secondary infection. Do not break the blister. Topical corticosteroid ointments and oral antihistamines may relieve the itching associated with these reactions.

Site personnel with a known hypersensitivity to stinging insects will keep required emergency medication on or near their person at all times

## Spiders

A large variety of spiders may be encountered during site activities. Extreme caution must be used when lifting logs and debris, since spiders are typically found in these areas.

While most spider bites merely cause localized pain, swelling, reddening, and in some cases, tissue damage, there are a few spiders that, due to the severity of the physiological affects caused by their venom, are dangerous.

**Black Widow:** The black widow is a coal-black bulbous spider 3/4 to 1 1/2 inches in length, with a bright red hourglass on the under side of the abdomen. The black widow is usually found in dark moist locations, especially under rocks, rotting logs and may even be found in outdoor toilets where they inhabit the underside of the seat. Victims of a black widow bite may exhibit the following signs or symptoms:

- Sensation of pinprick or minor burning at the time of the bite
- Appearance of small punctures (but sometimes none are visible)
- After 15 to 60 minutes, intense pain is felt at the site of the bite which spreads quickly, and is followed by profuse sweating, rigid abdominal muscles, muscle spasms, breathing difficulty, slurred speech, poor coordination, dilated pupils and generalized swelling of face and extremities

**Brown Recluse:** The brown or violin spider is brownish to tan in color, rather flat, and 1/2 to 5/8 inches long. However, unlike the typical species, this spider has been encountered without a violin or “fiddle” shaped mark on the top of the head. Of the brown spider, there are three varieties found in the United States that present a problem to site personnel. These are the brown recluse, the desert violin and the Arizona violin. These spiders may be found in a variety of locations including trees, rocks or in dark locations. Victims of a brown or violin spider bite may exhibit the following signs or symptoms:

- Blistering at the site of the bite, followed by a local burning at the site 30 to 60 minutes after the bite
- Formation of a large, red, swollen, postulating lesion with a bull's-eye appearance
- Systemic affects may include a generalized rash, joint pain, chills, fever, nausea and vomiting
- Pain may become severe after 8 hours, with the onset of tissue necrosis

There is no effective first aid treatment for either of these bites. Except for very young, very old or weak victims, spider bites are not considered to be life threatening. However, medical treatment must be sought to reduce the extent of damage caused by the injected toxins.

#### **Brown Recluse Spider**



#### **Black Widow Spider**



First aid should include:

- If possible, catch the spider to confirm its identity. Even if the body is crushed, save it for identification
- Clean the bitten area with soap and water or rubbing alcohol
- To relieve pain, place an ice pack over the bite
- Keep the victim quiet and monitor breathing

Seek immediate medical attention

### **Sensitivity Reaction to Insect Stings or Bites**

A sensitivity reaction is one of the more dangerous and acute effects of insect bites or stings. It is the most common cause of fatalities from bites, particularly from bees, wasps, and spiders. Anaphylactic shock due to stings can lead to severe reactions in the circulatory, respiratory, and central nervous system. This can also result in death.

Site personnel must be questioned regarding their allergic reaction to insect bites. Anyone knowingly allergic should be required to carry and know how to use a response kit (e.g., Epi-Kit). First aid providers must be instructed on how to use the kit also. The kit must be inspected to ensure it is updated.

Administer first aid and observe persons reporting stings for signs of allergic reaction, such as unusual swelling, nausea, dizziness, and shock. At the first sign of these symptoms, take the individual to a medical facility for attention.

### **Insect Borne Diseases**

Diseases that are spread by insects include the following: Lyme Disease (tick); Bubonic and other forms of Plague (fleas); Malaria, West Nile Virus and Equine Encephalitis (mosquito).

### **Tick Borne Diseases**

Lyme disease is the second most rapidly spreading disease in the U.S.

### **Lyme Disease**

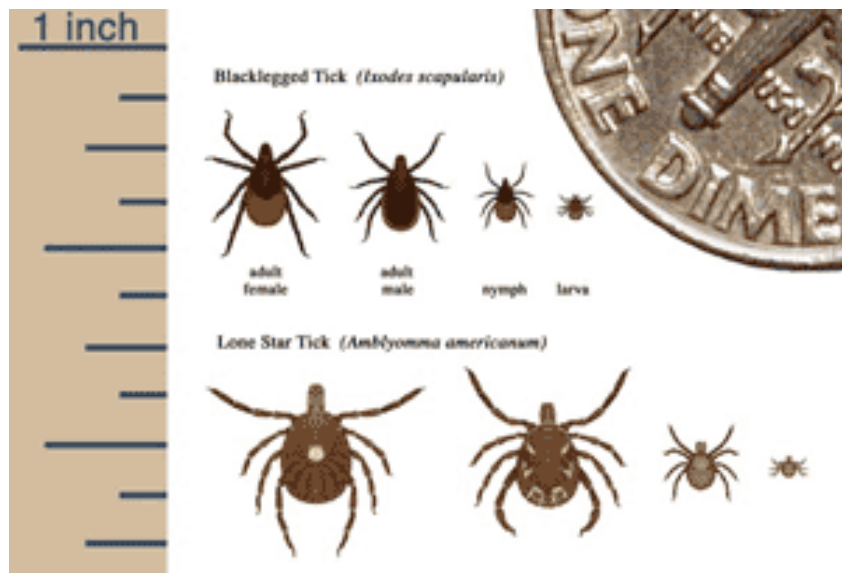
#### **1. Facts**

Definition:

- Bacterial infection transmitted by the bite of an infected black-legged tick more popularly known as the deer tick.
- Prevalence (nationwide and other countries).
- Three stages/sizes of deer ticks:
  - Larvae
  - Nymph
  - Adult

Tick season is May through October.

Not all ticks transmit Lyme disease (Black legged or deer tick [upper] compared to the Lone Star tick [lower])



- Ticks must be attached for several hours before Lyme disease can be transmitted.
- Being bitten by a tick does not mean you will get Lyme disease.

## 2. Prevention and Protection:

- Wear light-colored, tight-knit clothing.
- Wear long pants and long-sleeved shirts.
- Tuck pant legs into shoes or boots.
- Wear a hat.
- Use insect repellent containing DEET ((follow manufacturer's instructions for use).
- Check yourself daily for ticks after being in grassy, wooded areas.
- Request information from the Health and Safety Medical Section regarding Lyme Disease.

## 3. If Bitten:

- Remove the tick immediately with fine-tipped tweezers. Grasp the tick as close to the skin as possible. Pull gently but firmly without twisting or crushing the tick.
- Wash your hands and dab the bite with an antiseptic.

- Save the tick in a jar in some alcohol. Label the jar with the date of the bite, the area where you picked up the tick and the spot on your body where you were bitten.
- Monitor the bite for any signs of infection or rash.

#### 4. Symptoms:

Early Signs (may vary from person to person)

- Expanding skin rash.
- Flu-like symptoms during summer or early fall that include the following:
  - Chills, fever, headache, swollen lymph nodes.
  - Stiff neck, aching joints, and muscles.
  - Fatigue.
- Later signs
  - Nervous system problems.
  - Heart problems.
  - Arthritis, especially in knees.

#### 5. Upon Onset of Symptoms:

- Notify your Safety Officer (SO) and your supervisor.

### **Ehrlichiosis**

Ehrlichiosis is the general name used to describe several bacterial diseases that affect animals and humans. These diseases are caused by the organisms in the genus *Ehrlichia*. Worldwide, there are currently four ehrlichial species that are known to cause disease in humans.

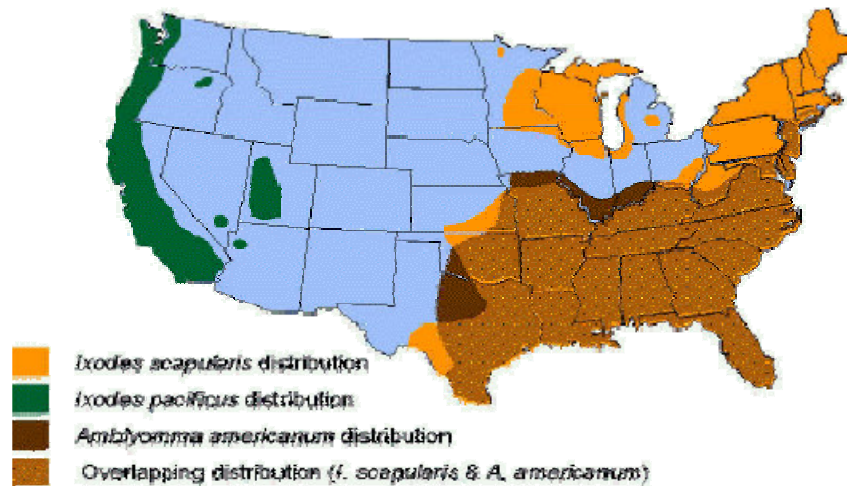
In the United States, ehrlichiae are transmitted by the bite of an infected tick. The lone star tick (*Amblyomma americanum*) and the blacklegged tick (*Ixodes scapularis*) are known vectors of ehrlichiosis.

The symptoms of ehrlichiosis may resemble symptoms of various other infectious and non-infectious diseases. These clinical features generally include fever, headache, fatigue, and muscle aches. Other signs and symptoms may include nausea, vomiting, diarrhea, cough, joint pains, confusion, and occasionally rash. Symptoms typically appear after an incubation period of 5-10 days following the tick bite. It is possible that many individuals who become infected with ehrlichiae do not become ill or they develop only very mild symptoms.

Most cases of ehrlichiosis are reported within the geographic distribution of the vector ticks (see map below). Occasionally, cases are reported from areas outside the distribution of the tick vector. In most instances, these cases have involved persons who traveled to areas where the diseases are endemic, and who had been bitten by an infected tick and developed symptoms after

returning home. Therefore, if you traveled to an ehrlichiosis-endemic area 2 weeks prior to becoming ill, you should tell your doctor where you traveled.

**Figure 20. Areas where human ehrlichiosis may occur based on approximate distribution of vector tick species**



A diagnosis of ehrlichiosis is based on a combination of clinical signs and symptoms and confirmatory laboratory tests. Blood samples can be sent to a reference laboratory for testing. However, the availability of the different types of laboratory tests varies considerably. Other laboratory findings indicative of ehrlichiosis include low white blood cell count, low platelet count, and elevated liver enzymes.

Ehrlichiosis is treated with a tetracycline antibiotic, usually doxycycline.

Very little is known about immunity to ehrlichial infections. Although it has been proposed that infection with ehrlichiae confers long-term protection against reinfection, there have been occasional reports of laboratory-confirmed reinfection. Short-term protection has been described in animals infected with some *Ehrlichia* species and this protection wanes after about 1 year. Clearly, more studies are needed to determine the extent and duration of protection against reinfection in humans.

Limiting exposure to ticks reduces the likelihood of infection in persons exposed to tick-infested habitats. Prompt careful inspection of your body and removal of crawling or attached ticks is an important method of preventing disease. It may take 24–48 hours of attachment before microorganisms are transmitted from the tick to you.

### **Preventive measures - Follow protection protocols for Lyme disease**

#### **Babesiosis**

Babesiosis is an intraerythrocytic parasitic infection caused by protozoa of the genus *Babesia* and transmitted through the bite of the *Ixodes* tick, the same vector responsible for transmission of Lyme disease. While most cases are tick-borne, transfusion and transplacental transmission

have been reported. In the United States, babesiosis is usually an asymptomatic infection in healthy individuals. Several groups of patients become symptomatic, and, within these subpopulations, significant morbidity and mortality occur. The disease most severely affects patients who are elderly, immunocompromised, or asplenic. Among those symptomatically infected, the mortality rate is 10% in the United States.

The primary vectors of the parasite are ticks of the genus *Ixodes*. In the United States, the black-legged tick, *Ixodes scapularis* (also known as *Ixodes dammini*) is the primary vector for the parasite. The *Ixodes* tick vector for *Babesia* is the same vector that locally transmits *Borrelia burgdorferi*, the agent implicated in Lyme disease. The primary US animal reservoir is the white-footed mouse, *Peromyscus leucopus*. Additionally, white-tailed deer serve as transport hosts for the adult tick vector, *I. scapularis*.

The Ixodid ticks ingest *Babesia* during feeding from the host, multiply the protozoa in their gut wall, and concentrate it in their salivary glands. The tick inoculates a new host when feeding again. The parasite then infects red blood cells (RBCs) and differentiated and undifferentiated trophozoites are produced. The former produce 2-4 merozoites that disrupt the RBC and go on to invade other RBCs. This leads to hemolytic anemia, thrombocytopenia, and atypical lymphocyte formation. Alterations in RBC membranes cause decreased conformability and increased red cell adherence, which can lead to development of acute respiratory distress syndrome (ARDS) among those severely affected.

The signs and symptoms mimic malaria and range in severity from asymptomatic to septic shock.

Symptoms include: Generalized weakness, fatigue, depression, fever, anorexia and weight loss, CNS - Headache, photophobia, neck stiffness, altered sensorium, pulmonary - Cough, shortness of breath, GI - Nausea, vomiting, abdominal pain, Musculoskeletal - Arthralgia and myalgia and Renal - Dark urine

## **Prevention**

Prevention measures are the same as for Lyme and other insect borne diseases

## **Tularemia**

**Tularemia** (also known as "rabbit fever") is a serious infectious disease caused by the bacterium *Francisella tularensis*. The disease is endemic in North America. The primary vectors are ticks and deer flies, but the disease can also be spread through other arthropods. Animals such as rabbits, prairie dogs, hares and muskrats serve as reservoir hosts.

Depending on the site of infection, tularemia has six characteristic clinical syndromes: ulceroglandular, glandular, oropharyngeal, pneumonic, oculoglandular, and typhoidal.

The disease has a very rapid onset, with headache, fatigue, dizziness, muscle pains, loss of appetite and nausea. Face and eyes redden and become inflamed. Inflammation spreads to the

lymph nodes, which enlarge and may suppurate (mimicking bubonic plague). Lymph node involvement is accompanied by a high fever. Death may result.

*Francisella tularensis* is one of the most infective bacteria known; fewer than ten organisms can cause disease leading to severe illness. The bacteria penetrate into the body through damaged skin and mucous membranes, or through inhalation. Humans are most often infected by tick bite or through handling an infected animal. Ingesting infected water, soil, or food can also cause infection. Tularemia can also be acquired by inhalation; hunters are at a higher risk for this disease because of the potential of inhaling the bacteria during the skinning process. Tularemia is not spread directly from person to person.

No vaccine is available to the general public. The best way to prevent tularemia infection is to wear rubber gloves when handling or skinning rodents or lagomorphs (as rabbits), avoid ingesting uncooked wild game and untreated water sources, and wearing long-sleeved clothes and using an insect repellent to prevent tick bites.

### **Prevention**

No vaccine is available to the general public. The best way to prevent tularemia infection is to wear rubber gloves when handling or skinning rodents or lagomorphs (as rabbits), avoid ingesting uncooked wild game and untreated water sources, and wearing long-sleeved clothes and using an insect repellent to prevent tick bites.

### **Other diseases primarily transmitted by Arthropods (Ticks, mites, lice etc.)**

**Typhus** (Not to be confused with Typhoid Fever [discussed in these FLDs])

*For the unrelated disease caused by *Salmonella typhi*, see Typhoid fever. For the unrelated disease caused by *Salmonella paratyphi*, please refer to Paratyphoid fever. For the monster of Greek mythology, see Typhus (monster).*

**Typhus** is any one of several similar diseases caused by louse-borne bacteria. The name comes from the Greek *typhos*, meaning smoky or lazy, describing the state of mind of those affected with typhus. *Rickettsia* is endemic in rodent hosts, including mice and rats, and spreads to humans through mites, fleas and body lice. The arthropod vector flourishes under conditions of poor hygiene, such as those found in prisons or refugee camps, amongst the homeless, or until the middle of the 20th century, in armies in the field. In tropical countries, typhus is often mistaken for dengue fever.

### **Endemic typhu**

Endemic typhus (also called "flea-borne typhus" and "murine typhus" or "rat flea typhus") is caused by the bacteria *Rickettsia typhi*, and is transmitted by the flea that infest rats. Symptoms of endemic typhus include headache, fever, chills, myalgia, nausea, vomiting, and cough.



Endemic typhus is highly treatable with antibiotics. Most people recover fully, but death may occur in the elderly, severely disabled or patients with a depressed immune system.

## **Encephalitis Arboviral Encephalitides**

### **Perspectives**

Arthropod-borne viruses, i.e., arboviruses, are viruses that are maintained in nature through biological transmission between susceptible vertebrate hosts by blood feeding arthropods (mosquitoes, psychodids, ceratopogonids, and ticks). Vertebrate infection occurs when the infected arthropod takes a blood meal. The term 'arbovirus' has no taxonomic significance. Arboviruses that cause human encephalitis are members of three virus families: the *Togaviridae* (genus Alphavirus, *Flaviviridae*, and *Bunyaviridae*).

All arboviral encephalitides are zoonotic, being maintained in complex life cycles involving a nonhuman primary vertebrate host and a primary arthropod vector. These cycles usually remain undetected until humans encroach on a natural focus, or the virus escapes this focus via a secondary vector or vertebrate host as the result of some ecologic change. Humans and domestic animals can develop clinical illness but usually are "dead-end" hosts because they do not produce significant viremia, and do not contribute to the transmission cycle. Many arboviruses that cause encephalitis have a variety of different vertebrate hosts and some are transmitted by more than one vector. Maintenance of the viruses in nature may be facilitated by vertical transmission (e.g., the virus is transmitted from the female through the eggs to the offspring).

Arboviral encephalitides have a global distribution, but there are four main virus agents of encephalitis in the United States, all of which are transmitted by mosquitoes. A new Powassan-like virus has recently been isolated from deer ticks. Its relatedness to Powassan virus and its ability to cause disease has not been well documented. Most cases of arboviral encephalitis occur from June through September, when arthropods are most active. In milder (i.e., warmer) parts of the country, where arthropods are active late into the year, cases can occur into the winter months.

**There is expanded discussion of several of these diseases (West Nile and Eastern Equine Encephalitis elsewhere in this document. A more general discussion is found in Attachment 2.**

## Mosquito Borne Diseases

### Malaria

**Malaria** is a mosquito-borne disease caused by a parasite. Four kinds of malaria parasites can infect humans: *Plasmodium falciparum*, *P. vivax*, *P. ovale*, and *P. malariae*.



People with malaria often experience fever, chills, and flu-like illness. Left untreated, they may develop severe complications and die. Each year 350-500 million cases of malaria occur worldwide. Infection with any of the malaria species can make a person feel very ill; infection with *P. falciparum*, if not promptly treated, may be fatal. Although malaria can be a fatal disease, illness and death from malaria are largely preventable.

This sometimes fatal disease can be prevented and cured. Bed nets, insecticides, and anti-malarial drugs are effective tools to fight malaria in areas where it is transmitted. Travelers to a malaria-risk area should avoid mosquito bites and take a preventive anti-malarial drug. Malaria was eradicated from the United States in the early 1950s. However, malaria is common in many developing countries and travelers who visit these areas risk getting malaria.

Returning travelers and arriving immigrants could also reintroduce the disease in the United States if they are infected with malaria when they return. The mosquito that transmits malaria, *Anopheles*, is found throughout much of the United States. If local mosquitoes bite an infected person, those mosquitoes can, in turn, infect local residents (*introduced malaria*).

Because the malaria parasite is found in red blood cells, malaria can also be transmitted through blood transfusion, organ transplant, or the shared use of needles or syringes contaminated with blood. Malaria may also be transmitted from a mother to her fetus before or during delivery ("congenital" malaria).

Malaria is not transmitted from person to person like a cold or the flu. You cannot get malaria from casual contact with malaria-infected people.

## **Prevention and control**

You can prevent malaria by:

- keeping mosquitoes from biting you, especially at night
- taking anti-malarial drugs to kill the parasites
- eliminating places where mosquitoes breed
- spraying insecticides on walls to kill adult mosquitoes that come inside
- sleeping under bed nets - especially effective if they have been treated with insecticide,
- wearing insect repellent and long-sleeved clothing if out of doors at night

The surest way for you and your health-care provider to know whether you have malaria is to have a diagnostic test where a drop of your blood is examined under the microscope for the presence of malaria parasites. If you are sick and there is any suspicion of malaria (for example, if you have recently traveled in a malaria-risk area) the test should be performed without delay.

The disease should be treated early in its course, before it becomes severe and poses a risk to the patient's life. Several good anti-malarial drugs are available, and should be administered early on. The most important step is to think about malaria, so that the disease is diagnosed and treated in time.

## **West Nile Virus**

West Nile virus (WNV) is a potentially serious illness. Experts believe WNV is established as a seasonal epidemic in North America that flares up in the summer and continues into the fall. This fact sheet contains important information that can help you recognize and prevent WNV.

The easiest and best way to avoid WNV is to prevent mosquito bites.

- When you are outdoors, use insect repellent containing an EPA-registered active ingredient. Follow the directions on the package.
- Many mosquitoes are most active at dusk and dawn. Be sure to use insect repellent and wear long sleeves and pants at these times or consider staying indoors during these hours.
- Make sure you have good screens on your windows and doors to keep mosquitoes out.
- Get rid of mosquito breeding sites by emptying standing water from buckets, barrels and drainage ditches.

About one in 150 people infected with WNV will develop severe illness. The severe symptoms can include high fever, headache, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, vision loss, numbness and paralysis. These symptoms may last several weeks, and neurological effects may be permanent.

Up to 20 percent of the people who become infected have symptoms such as fever, headache, and body aches, nausea, vomiting, and sometimes swollen lymph glands or a skin rash on the chest, stomach and back. Symptoms can last for as short as a few days, though even healthy people have become sick for several weeks.

Approximately 80 percent of people (about 4 out of 5) who are infected with WNV will not show any symptoms at all. Most often, WNV is spread by the bite of an infected mosquito. Mosquitoes become infected when they feed on infected birds. Infected mosquitoes can then spread WNV to humans and other animals when they bite.

In a very small number of cases, WNV also has been spread through blood transfusions, organ transplants, breastfeeding and even during pregnancy from mother to baby.

WNV is not spread through casual contact such as touching or kissing a person with the virus.

Symptoms typically develop between 3 - 14 days after being bitten by an infected mosquito.

There is no specific treatment for WNV infection. In cases with milder symptoms, people experience symptoms such as fever and aches that pass on their own, although even healthy people have become sick for several weeks. In more severe cases, people usually need to go to the hospital where they can receive supportive treatment including intravenous fluids, help with breathing and nursing care.

Milder WNV illness improves on its own, and people do not necessarily need to seek medical attention for this infection though they may choose to do so. If you develop symptoms of severe WNV illness, such as unusually severe headaches or confusion, seek medical attention immediately. Severe WNV illness usually requires hospitalization. Pregnant women and nursing mothers are encouraged to talk to their doctor if they develop symptoms that could be WNV. People over the age of 50 are more likely to develop serious symptoms of WNV if they do get sick and should take special care to avoid mosquito bites.

The more time you're outdoors, the more time you could be bitten by an infected mosquito. Pay attention to avoiding mosquito bites if you spend a lot of time outside, either working or playing.

All donated blood is checked for WNV before being used. The risk of getting WNV through blood transfusions and organ transplants is very small, and should not prevent people who need surgery from having it. If you have concerns, talk to your doctor.

## **Equine Encephalitis**

Eastern equine encephalitis (EEE) is a mosquito-borne viral disease. EEE virus (EEEV) occurs in the eastern half of the United States where it causes disease in humans, horses, and some bird species. Because of the high mortality rate, EEE is regarded as one of the most serious mosquito-borne diseases in the United States.

EEEV is transmitted to humans through the bite of an infected mosquito. It generally takes from 3 to 10 days to develop symptoms of EEE after being bitten by an infected mosquito. The main EEEV transmission cycle is between birds and mosquitoes.

Many species of mosquitoes can become infected with EEEV. The most important mosquito species in maintaining the bird-mosquito transmission cycle is *Culiseta melanura*, which reproduces in freshwater hardwood swamps. *Culiseta melanura*, however, is not considered to be an important vector of EEEV to horses or humans because it feeds almost exclusively on birds.

Transmission to horses or humans requires mosquito species capable of creating a “bridge” between infected birds and uninfected mammals such as some *Aedes*, *Coquillettidia*, and *Culex* species.

Horses are susceptible to EEE and some cases are fatal. EEEV infections in horses, however, are not a significant risk factor for human infection because horses are considered to be “dead-end” hosts for the virus (i.e., the amount of EEEV in their bloodstreams is usually insufficient to infect mosquitoes).

Eastern equine encephalitis virus is a member of the family Togaviridae, genus *Alphavirus* closely related to Western equine encephalitis virus and Venezuelan equine encephalitis virus

Many persons infected with EEEV have no apparent illness. In those persons who do develop illness, symptoms range from mild flu-like illness to inflammation of the brain, coma and death.

The mortality rate from EEE is approximately one-third, making it one of the most deadly mosquito-borne diseases in the United States.

There is no specific treatment for EEE; optimal medical care includes hospitalization and supportive care (for example, expert nursing care, respiratory support, prevention of secondary bacterial infections, and physical therapy, depending on the situation).

Approximately half of those persons who survive EEE will have mild to severe permanent neurologic damage.

Incidence rate includes:

- Approximately 220 confirmed cases in the US 1964-2004, Average of 5 cases/year, with a range from 0-15 cases
- States with largest number of cases includes New Jersey.
- EEEV transmission is most common in and around freshwater hardwood swamps in the Atlantic Coast states and the Great Lakes region.

- Human cases occur relatively infrequently, largely because the primary transmission cycle takes place in and around swampy areas where human populations tend to be limited.

### **Risk Groups:**

- Residents of and visitors to endemic areas (areas with an established presence of the virus)
- People who engage in outdoor work and recreational activities in endemic areas.
- Persons over age 50 and younger than age 15 seem to be at greatest risk for developing severe EEE when infected with the virus.

### **Prevention**

- A vaccine is available to protect equines.
- People should avoid mosquito bites by employing personal and workplace protection measures, such as using an EPA-registered repellent according to manufacturers' instructions, wearing protective clothing, avoiding outdoor activity when mosquitoes are active (some bridge vectors of EEEV are aggressive day-biters), and removing standing water that can provide mosquito breeding sites.
- There are laboratory tests to diagnosis EEEV infection including serology, especially IgM testing of serum and cerebrospinal fluid (CSF), and neutralizing antibody testing of acute- and convalescent-phase serum.

### **Meningitis**

Meningitis is a viral disease that can affect the central nervous system that is transmitted through the bite from an infected mosquito.

Symptoms can be nonexistent or severe and flu-like, with fever, chills, tiredness, headache, nausea and vomiting. If not treated promptly the disease can be fatal.

### **Prevention**

- A vaccine is available. It's 80% effective after a single dose and 97.5% effective after a second dose.

Use precautions as for other mosquito borne diseases. Avoid mosquito bites by employing personal and workplace protection measures, such as using an EPA-registered repellent according to manufacturers' instructions, wearing protective clothing, avoiding outdoor activity when mosquitoes are active and removing standing water that can provide mosquito breeding sites.

### **Deer Flies (See Tularemia above)**

## **Fleas**

Flea is a common name for insects of the order Siphonaptera which are wingless insects with mouthparts adapted for piercing skin and sucking blood. Fleas are external parasites, living by hematophagy off the blood of mammals (including humans). Some species include the cat flea (*Ctenocephalides felis*), dog flea (*Ctenocephalides canis*), and human flea (*Pulex irritans*).

Fleas are small (1.5 to 3.3 mm) long, agile, dark-colored, wingless insect with tube-like mouth parts adapted to feeding on the blood of their hosts. Their legs are long, with the hind pair well adapted for jumping. A flea can jump vertically up to seven inches and horizontally up to 13 inches. The flea body is hard, polished, and covered with many hairs and short spines directed backwards which assists its movement on the host. The body is able to withstand great pressure. Hard squeezing between the fingers is not normally sufficient to kill a flea.

Fleas lay tiny white oval-shaped eggs. The larva is small, pale, has bristles covering its worm-like body, lacks eyes, and has mouthparts adapted to chewing.

Fleas can cause medical problems include flea allergy dermatitis, secondary skin irritations and, in extreme cases, anemia, tapeworms, and stomach flu. Fleas can transmit murine typhus (endemic typhus) fever among animals and from animal to humans. Fleas can also transmit bubonic plague. Tapeworms normally infest in human severe cases. Although the bite is rarely felt, it is the resulting irritation caused by the flea salivary secretions that varies among individuals. Some result in a severe reaction including a general rash or inflammation resulting in secondary infections caused by scratching the irritated skin. Most bites are found on the feet and legs with the formation of small, hard, red, slightly raised itching spots with a single puncture point in the center of each spot.

### **Treatment**

Flea bites can be treated with anti-itch creams, usually antihistamines or hydrocortisone.

## **Bed Bugs**

Bed bugs are small parasitic insects that feed on human blood. A number of health effects may occur due to bed bugs including skin rashes, prominent blisters, psychological effects and allergic symptoms. Diagnosis involves finding the bed bugs and the occurrence of compatible symptoms. Treatment is otherwise symptomatic.

Adult bed bugs are reddish-brown, flattened, oval and wingless. Bed bugs have microscopic hairs that give them a banded appearance. Adults grow to 4-5mm in length and 1.5-3 mm wide. A bed bug pierces the skin of its host with two hollow feeding tubes shaped like tongues. The one tube injects its saliva, which contains anticoagulants and anesthetics, while the other draws blood of its host. After feeding for approximately five minutes, the bug returns to its hiding place. Although bed bugs can live for a year without feeding, they normally feed every five to ten days.

Eradication of bed bugs frequently requires a combination of pesticide and non-pesticide approaches. Pyrethroids, dichlorvos, and malathion have historically been effective. Mechanical approaches include vacuuming and heat treating or wrapping mattresses have also been recommended.



**ATTACHMENT 1**  
**RICKETTSIAL INFECTIONS**

## **Rickettsial Infections**

### **Description**

Many species of *Rickettsia* can cause illnesses in humans (Table below). The term “rickettsiae” conventionally embraces a polyphyletic group of microorganisms in the class Proteobacteria, comprising species belonging to the genera *Rickettsia*, *Ehrlichia*, *Coxiella*, and *Bartonella*. These agents are usually not transmissible directly from person to person except by blood transfusion or organ transplantation, although sexual and placental transmission has been proposed for *Coxiella*. Transmission generally occurs via an infected arthropod vector or through exposure to an infected animal reservoir host. However, sennetsu fever is acquired following consumption of raw fish products. The clinical severity and duration of illnesses associated with different rickettsial infections vary considerably, even within a given antigenic group. Rickettsioses range in severity from diseases that are usually relatively mild (cat scratch disease) to those that can be life-threatening (murine typhus) and they vary in duration from those that can be self-limiting to chronic (Q fever and bartonellosis) or recrudescent (Brill-Zinsser disease). Most patients with rickettsial infections recover with timely use of appropriate antibiotic therapy.

Travelers may be at risk for exposure to agents of rickettsial diseases if they engage in occupational or recreational activities which bring them into contact with habitats that support the vectors or animal reservoir species associated with these pathogens.

The geographic distribution and the risks for exposure to rickettsial agents are described below and in the Table below.

### **Trench Fever**

Trench fever, which is caused by *Bartonella quintana*, is transmitted from one person to another by the human body louse. Contemporary outbreaks of both diseases are rare in most developed countries and generally occur only in communities and populations in which body louse infestations are frequent, especially during the colder months when louse-infested clothing is not laundered. Foci of trench fever have also been recognized among homeless populations in urban centers of industrialized countries. Travelers who are not at risk of exposure to body lice or to persons with lice are unlikely to acquire these illnesses. However, health-care workers who care for these patients may be at risk for acquiring louse-borne illnesses through inhalation or inoculation of infectious louse feces into the skin or conjunctiva.

## Murine Typhus

Murine typhus, which is caused by infection with *Rickettsia typhi*, is transmitted to humans by rat fleas, particularly during exposure in rat-infested buildings (3). Flea-infested rats can be found throughout the year in humid tropical environments, especially in harbor or riverine environments. In temperate regions, they are most common during the warm summer months.

Travelers who participate in outdoor activities in grassy or wooded areas (e.g., trekking, camping, or going on safari) may be at risk for acquiring tick-borne illnesses, including those caused by *Rickettsia*, and *Ehrlichia* species (see below).

**TABLE Epidemiologic features and symptoms of rickettsial diseases**

ANTIGENIC GROUP	DISEASE	AGENT	PREDOMINANT SYMPTOMS*	VECTOR OR ACQUISITION MECHANISM	ANIMAL RESERVOIR	GEOGRAPHIC DISTRIBUTION OUTSIDE THE US
Typhus fevers	Murine typhus	<i>R. typhi</i>	As above, generally less severe	Rat flea	Rats, mice	Worldwide
Spotted fevers						
Coxiella	Q fever	<i>Coxiella burnetii</i>	Fever, headache, chills, sweating, pneumonia, hepatitis, endocarditis	Most human infections are acquired by inhalation of infectious aerosols; tick	Goats, sheep, cattle, domestic cats, other	Worldwide
Bartonella	Cat-scratch disease	<i>Bartonella henselae</i>	Fever, adenopathy, neuroretinitis, encephalitis	Cat flea	Domestic cats	Worldwide
	Trench fever	<i>B. quintana</i>	Fever, headache, pain in shins, splenomegaly, disseminated rash	Human body louse	Humans	Worldwide
Ehrlichia	Ehrlichiosis	<i>Ehrlichia chaffeensis</i> <sup>#</sup>	Fever, headache, nausea, occasionally rash	Tick	Various large and small mammals, including deer and rodents	Worldwide

This represents only a partial list of symptoms. Patients may have different symptoms or only a few of those listed.

## Anaplasmosis and Ehrlichiosis

Human ehrlichiosis and anaplasmosis are acute tick-borne diseases, associated with the lone star tick, *Amblyomma americanum*, and *Ixodes* ticks, respectively. Because one tick may be infected with more than one tick-borne pathogen (e.g. *Borrelia burgdorferi*, the causative agent of Lyme disease, or various *Babesia* species, agent of human babesiosis), patients may be present with

atypical clinical symptoms that complicate treatment. Ehrlichioses and anaplasmosis are characterized by infection of different types of leukocytes, where the causative agent multiplies in cytoplasmic membrane-bound vacuole called morulae. Morulae can sometimes be detected in Giemsa-stained blood smears.

## **Q FEVER**

Q fever occurs worldwide, most often in persons who have contact with infected goat, sheep, cat and cattle, particularly parturient animals (especially farmers, veterinarians, butchers, meat packers, and seasonal workers). Travelers who visit farms or rural communities can be exposed to *Coxiella burnetii*, the agent of Q fever, through airborne transmission (via animal-contaminated soil and dust) or less commonly through consumption of unpasteurized milk products or by exposure to infected ticks. These infections may initially result in only mild and self-limiting influenza-like illnesses, but if untreated, infections may become chronic, particularly in persons with preexisting heart valve abnormalities or with prosthetic valves. Such persons can develop chronic and potentially fatal endocarditis.

## **Cat-Scratch Disease**

Cat-scratch disease is contracted through scratches and bites from domestic cats, particularly kittens, infected with *Bartonella henselae*, and possibly from their fleas (3, 4). Exposure can therefore occur wherever cats are found.

## **Symptoms**

Clinical presentations of rickettsial illnesses vary (Table above), but common early symptoms, including fever, headache, and malaise, are generally nonspecific. Illnesses resulting from infection with rickettsial agents may go unrecognized or are attributed to other causes. Atypical presentations are common and may be expected with poorly characterized non-indigenous agents, so appropriate samples for examination by specialized reference laboratories should be obtained. A diagnosis of rickettsial diseases is based on two or more of the following: 1) clinical symptoms and an epidemiologic history compatible with a rickettsial disease, 2) the development of specific convalescent-phase antibodies reactive with a given pathogen or antigenic group, 3) a positive polymerase chain reaction test result, 4) specific immunohistologic detection of rickettsial agent, or 5) isolation of a rickettsial agent. Ascertaining the likely place and the nature of potential exposures is particularly helpful for accurate diagnostic testing.

## Prevention

With the exception of the louse-borne diseases described above, for which contact with infectious arthropod feces is the primary mode of transmission (through autoinoculation into a wound, conjunctiva, or inhalation), travelers and health-care providers are generally not at risk for becoming infected via exposure to an ill person. Limiting exposures to vectors or animal reservoirs remains the best means for reducing the risk for disease. Travelers and persons working in areas where organisms may be present should implement prevention based on avoidance of vector-infested habitats, use of repellents and protective clothing, prompt detection and removal of arthropods from clothing and skin, and attention to hygiene.

Q fever and *Bartonella* group diseases may pose a special risk for persons with abnormal or prosthetic heart valves, and *Rickettsia*, *Ehrlichia*, and *Bartonella* for persons who are immunocompromised.

## **ATTACHMENT 2**

### **ENCEPHALITIS ARBOVIRAL ENCEPHALITIDES**

## Encephalitis Arboviral Encephalitides

### Perspectives

Arthropod-borne viruses, i.e., arboviruses, are viruses that are maintained in nature through biological transmission between susceptible vertebrate hosts by blood feeding arthropods (mosquitoes, psychodids, ceratopogonids, and ticks). Vertebrate infection occurs when the infected arthropod takes a blood meal. The term 'arbovirus' has no taxonomic significance. Arboviruses that cause human encephalitis are members of three virus families: the *Togaviridae* (genus *Alphavirus*, *Flaviviridae*, and *Bunyaviridae*).

All arboviral encephalitides are zoonotic, being maintained in complex life cycles involving a nonhuman primary vertebrate host and a primary arthropod vector. These cycles usually remain undetected until humans encroach on a natural focus, or the virus escapes this focus via a secondary vector or vertebrate host as the result of some ecologic change. Humans and domestic animals can develop clinical illness but usually are "dead-end" hosts because they do not produce significant viremia, and do not contribute to the transmission cycle. Many arboviruses that cause encephalitis have a variety of different vertebrate hosts and some are transmitted by more than one vector. Maintenance of the viruses in nature may be facilitated by vertical transmission (e.g., the virus is transmitted from the female through the eggs to the offspring).

Arboviral encephalitides have a global distribution which is transmitted by mosquitoes. Powassan, is a minor cause of encephalitis in the northern United States, and is transmitted by ticks. A new Powassan-like virus has recently been isolated from deer ticks. Its relatedness to Powassan virus and its ability to cause disease has not been well documented. Most cases of arboviral encephalitis occur from June through September, when arthropods are most active. In milder (i.e., warmer) parts of the country, where arthropods are active late into the year, cases can occur into the winter months.

The majority of human infections is asymptomatic or may result in a nonspecific flu-like syndrome. Onset may be insidious or sudden with fever, headache, myalgias, malaise and occasionally prostration. Infection may, however, lead to encephalitis, with a fatal outcome or permanent neurologic sequelae. Fortunately, only a small proportion of infected persons progress to frank encephalitis.

Experimental studies have shown that invasion of the central nervous system (CNS), generally follows initial virus replication in various peripheral sites and a period of viremia. Viral transfer from the blood to the CNS through the olfactory tract has been suggested. Because the arboviral encephalitides are viral diseases, antibiotics are not effective for treatment and no effective antiviral drugs have yet been discovered.

## Prevention

Arboviral encephalitis can be prevented in two major ways: personal protective measures and public health measures to reduce the population of infected mosquitoes. Personal measures include reducing time outdoors particularly in early evening hours, wearing long pants and long sleeved shirts and applying mosquito repellent to exposed skin areas. Public health measures often require spraying of insecticides to kill juvenile (larvae) and adult mosquitoes.

Selection of mosquito control methods depends on what needs to be achieved; but, in most emergency situations, the preferred method to achieve maximum results over a wide area is aerial spraying. In many states aerial spraying may be available in certain locations as a means to control nuisance mosquitoes. Such resources can be redirected to areas of virus activity. When aerial spraying is not routinely used, such services are usually contracted for a given time period. Financing of aerial spraying costs during large outbreaks is usually provided by state emergency contingency funds. Federal funding of emergency spraying is rare and almost always requires a federal disaster declaration. Such disaster declarations usually occur when the vector-borne disease has the potential to infect large numbers of people, when a large population is at risk and when the area requiring treatment is extensive. Special large planes maintained by the United States Air Force can be called upon to deliver the insecticide(s) chosen for such emergencies. Federal disaster declarations have relied heavily on risk assessment by the CDC.

There are no commercially available human vaccines for these U.S. diseases.

## **Powassan Encephalitis**

Powassan (POW) virus is a flavivirus and currently the only well documented tick-borne transmitted arbovirus occurring in the United States and Canada. Recently a Powassan-like virus was isolated from the deer tick, *Ixodes scapularis*. Its relationship to POW and its ability to cause human disease has not been fully elucidated. POW's range in the United States is primarily in the upper tier States. In addition to isolations from man, the virus has been recovered from ticks (*Ixodes marxi*, *I. cookei* and *Dermacentor andersoni*) and from the tissues of a skunk (*Spilogale putorius*). It is a rare cause of acute viral encephalitis. POW virus was first isolated from the brain of a 5-year-old child who died in Ontario in 1958. Patients who recover may have residual neurological problems.

## **Other Arboviral Encephalitides**

Many other arboviral encephalitides occur throughout the world. Most of these diseases are problems only for those individuals traveling to countries where the viruses are endemic.

## **West Nile Encephalitis**

Discussed elsewhere in this document



## FLD 43 D HAZARDOUS PLANTS

A number of hazardous plants may be encountered during field operations. The ailments associated with these plants range from mild hay fever to contact dermatitis. Plants that present the greatest risk to site workers are those that produce allergic reactions and tissue injury.

### Plants That Cause Skin and Tissue Injury

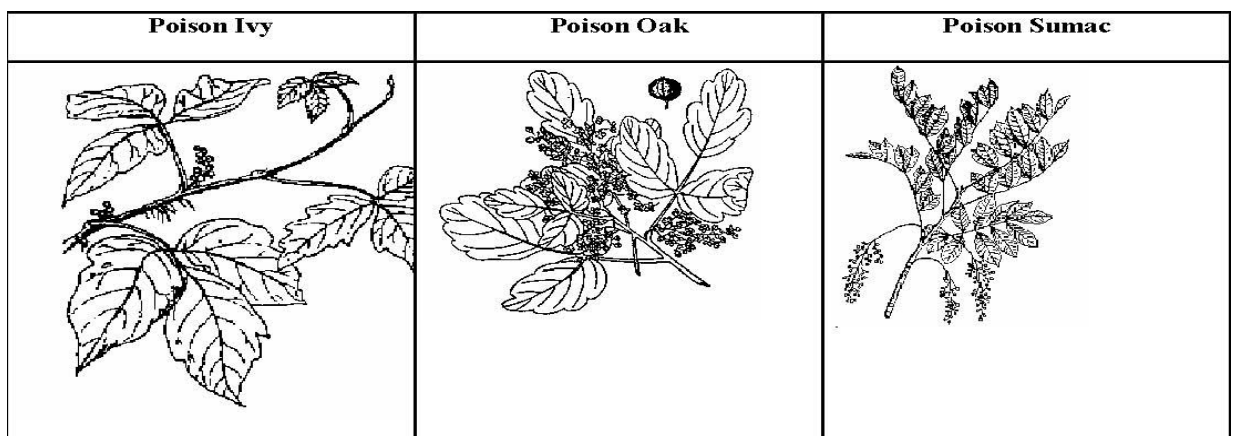
Contact with sharp leaves and thorns are of special concern to site personnel. This concern stems from the fact that punctures, cuts, and even minor scrapes caused by accidental contact may result in skin lesions and the introduction of fungi or bacteria through the skin. This is especially important in light of the fact that the warm moist environment created inside protective clothing is ideal for the propagation of fungal and bacterial infection. Personnel receiving any of the injuries listed above, even minor scrapes shall report immediately for continued observation and care. Keeping the skin covered as much as possible (i.e., long pants and long sleeved shirts) in areas where these plants are known to exist will limit much of the potential exposure.

### Plants That Cause an Allergic Reaction

The poisonous plants of greatest concern are poison ivy, poison oak, and poison sumac. Contact with the poisonous sap of these plants produces a severe rash characterized by redness, blisters, swelling, and intense burning and itching. The victim also may develop a high fever and may be very ill. Ordinarily, the rash begins within a few hours after exposure, but it may be delayed for 24 to 48 hours.

The most distinctive features of poison ivy and poison oak are their leaves, which are composed of three leaflets each. In certain seasons, both plants also have greenish-white flowers and berries that grow in clusters. Poison sumac is a tall shrub or small tree with 6 to 12 leaflets arranged in pairs with a single leaflet at the end. This plant grows in wooded, swampy areas.

**Poison Ivy/Poison Oak/Poison Sumac**



The reaction associated with exposure to these plants will generally cause the following signs and symptoms:

- Blistering at the site of contact, usually occurring within 12 to 48 hours after contact
- Reddening, swelling, itching and burning at the site of contact
- Pain, if the reaction is severe
- Conjunctivitis, asthma, and other allergic reactions if the person is extremely sensitive to the poisonous plant toxin

If the rash is scratched, secondary infections can occur. Preventive measures that are effective for most site personnel include:

- Avoid contact with any poisonous plants on site, and keep a steady watch to identify, report and mark poisonous plants found on site
- Wash hands, face or other exposed areas at the beginning of each break period and at the end of each workday
- Avoid contact with, and wash on a daily basis, contaminated tools, equipment and clothing
- Barrier creams, detoxification/wash solutions and orally administered desensitization may prove effective and should be tried to find the best preventive solution

Keeping the skin covered as much as possible (i.e., long pants and long sleeved shirts) in areas where these plants are known to exist will limit much of the potential exposure.

### **Plants That are Poisonous**

There are a number of plants worldwide beside poison ivy, oak and sumac which have poisonous properties. In many cases consumption of these plants or parts of these plants can result in poisoning. In other cases, contact with the plants may be poisonous. The following is a listing with pertinent information on poisonous properties and locations of a number of plants.

In general, when working in the outdoors or where you may come in contact with household plants or where your families may come in contact with these plants, it is important that as soon as possible after contact the area or areas should be thoroughly washed and hands must be thoroughly washed before eating drinking, smoking or any other hand to mouth contact.

In keeping with our 24/7 BBS concept, it is important to remember that children are particularly vulnerable to many of the poisonous parts of these plants. Many of these poisonous parts resemble non-poisonous food items such as berries and are attractive.

As with most lists there is extensive information but the list may not include all poisonous plants.

It is important to remember that this document is a starting point to be supplemented with local information. The majority of this information is from a list found in Wikipedia an on line Dictionary readily accessible via Google. The website has pictures of these plants as well as links to other information sources.

# POISONOUS PLANTS

From Wikipedia,

This is a list of plants containing poisonous parts that pose a serious risk of illness, injury, or death to humans.

## Poisonous Food Plants

- Apple (*Malus domestica*) **Found worldwide in cooler climates.** Seeds contain cyanogenic glycosides; although the amount found in most apples won't kill a person.
- Cherry (*Prunus cerasus*), as well as other species (*Prunus spp*) such as peach (*Prunus persica*), plum (*Prunus domestica*), almond (*Prunus dulcis*) and apricot (*Prunus armeninaca*). **There are around 430 species of *Prunus*, spread throughout the northern temperate regions of the globe.** Leaves and seeds contain cyanogenic glycosides
- Rhubarb (*Rheum rhaponticum*) **Found worldwide.** Leaves, but not stems, contain oxalic acid salts, causing kidney disorders, convulsions, and coma. Rarely fatal.
- Tomato (*Solanum lycopersicum*) **Found worldwide.** Foliage and vines contain alkaloid poisons which cause digestive upset and nervous excitement.

## Other Poisonous Plants

- Autumn crocus. **Found in North America.** The bulbs are poisonous and cause nausea, vomiting, diarrhea. **Can be fatal.**
- Azalea **Found Worldwide.** All parts of the plant are poisonous and cause nausea, vomiting, depression, breathing difficulties, and coma. Rarely fatal.
- Bittersweet nightshade **Naturalized in North America.** All parts are poisonous, containing solanine and causing fatigue, paralysis, convulsions and diarrhea. Rarely fatal.
- Bleeding heart / Dutchman's breeches. **Found in North America.** Leaves and roots are poisonous and cause convulsions and other nervous symptoms.
- Black locust. **Naturalized in North America.** Pods are toxic
- Caladium / Elephant ear. **Ornamental plants in North America.** All parts of the plant are poisonous. Symptoms are generally irritation, pain, and swelling of tissues. If the mouth or tongue swells, breathing may be fatally blocked.

- Castor Oil Plant (*Ricinus communis*) Castor Oil Plant. **Found Worldwide.** The phytotoxin is **ricin**, an extremely toxic water soluble protein, which is concentrated in the seed. Also present are ricinine, an alkaloid, and an irritant oil. Causes burning in mouth and throat, convulsions, and is **often fatal**.
- Daffodil. **Found worldwide.** The bulbs are poisonous and cause nausea, vomiting, and diarrhea. **Can be fatal.**
- Daphne (*Daphne sp.*) **Ornamental plant worldwide.** The berries (either red or yellow) are poisonous, causing burns to mouth and digestive tract, followed by coma. **Often fatal.**
- Darnel/Poison Ryegrass (*Lolium temulentum*) **Usually grows in the same production zones as wheat and is considered a weed.** The seeds and seed heads of this common garden weed may contain the alkaloids temuline and loline. Some experts also point to the fungus ergot or fungi of the genus endoconidium both of which grow on the seed heads of rye grasses as an additional source of toxicity.
- Deadly nightshade (*Atropa belladonna*) **Naturalized in parts of North America.** All parts of the plant contain the toxic alkaloid atropine. The young plants and seeds are especially poisonous, causing nausea, muscle twitches, paralysis; **often fatal**.
- Dumbcane / dieffenbachia. **Found in tropical areas and popular as house plants.** All parts are poisonous, causing intense burning, irritation, and immobility of the tongue, mouth, and throat. Swelling can be severe enough to block breathing leading to death.
- Ivy. **Native to North America** where winters are not severe. The leaves and berries are poisonous, causing stomach pains, labored breathing, possible coma.
- Jerusalem cherry **United States** All parts, especially the berries, are poisonous, causing nausea and vomiting. **Looks like a cherry tomato.** It is occasionally fatal, especially to children.
- Lilies **Worldwide** There are some 3500 species that comprise the lily (Lilaceae) family. Some are beneficial including (foods such as onion, shallot, garlic, chives [all *Allium* spp] and asparagus) and some with medicinal uses (colchicine and red squill) Many produce alkalids which are poisonous, especially to cats.
- Manchineel (*Hippomane mancinella*) **Native to the Caribbean (including Puerto Rico and the Virgin Islands).** It is one of the most poisonous trees in the world All parts of this tree including the fruit contain toxic phorbol esters typical of the Euphorbiacea. Sap may cause burning of the skin and smoke from burning may cause eye irritation and blindness. Fruits, which are similar in appearance to an apple, are green or greenish-yellow when ripe.
- Oak Worldwide Most species foliage and acorns are mildly poisonous, causing digestive upset, heart trouble, contact dermatitis. Rarely fatal.

- Poison-ivy (*Toxicodendron radicans*), Poison-oak (*T. diversilobum*), and Poison Sumac (*T. vernix*) **North America** All parts of these plants contain a highly irritating oil with urushiol (this is actually not a poison but an allergen). Skin reactions can include blisters and rashes. It spreads readily to clothes and back again, and has a very long life. Infections can follow scratching.
- Pokeweed (*Phytolacca sp.*) **Native to North America.** Leaves, berries and roots contain phytolaccatoxin and phytolaccigenin - toxin in young leaves is reduced with each boiling and draining.

## **FLD 46 CONTROL OF EXPOSURE TO LEAD**

### **REFERENCES**

29 CFR 1926.62

### **RELATED FLDs AND PROGRAMS:**

*Occupational Medical Monitoring Program*

*Personal Protective Equipment Program*

*Respiratory Protection Program*

This FLD provides guidelines for controlling exposure to lead in the workplace. This WESTON-specific instruction applies corporate-wide and may require consultation and interpretation by a Certified Industrial Hygienist for unique applications.

Managers shall ensure employees are properly trained in the provisions of the standard prior to performing activities involving exposure to lead or lead compounds.

### **INTRODUCTION**

Based upon limited differences in compliance requirements between the General Industry and the Construction Industry Standards WESTON policy is to follow compliance requirements as determined in 29 CFR 1926.62, "Lead Exposure in Construction" for all activities which involve occupational exposure to lead. The forms of lead to which the standard applies is defined to include metallic lead, all inorganic lead compounds, and organic lead soaps.

This practice applies to occupational exposure to lead at or above the Action Level (AL). Specific requirements for medical monitoring, respiratory protection, hygiene facilities, etc. are not mandated until exposure reaches the AL or the Permissible Exposure Level (PEL).

The lead standard includes requirements addressing exposure assessment, methods of compliance, respiratory protection, protective clothing and equipment, hygiene facilities and practices, medical surveillance, medical removal protection, employee information and training, signs, recordkeeping, and observation of monitoring.

The lead standard lists specific tasks which require conformance with the most restrictive portions of the standard until monitoring indicates otherwise. The tasks include; abrasive blasting, welding, cutting and burning of steel or structures containing or coated with lead or lead products.

### **Permissible Exposure Level (PEL) and Action Level (AL)**

For both the general industry and the construction industry, the PEL for lead exposure is 50 $\mu$ g/m<sup>3</sup> and the AL is 30 $\mu$ g/m<sup>3</sup>.

For exposures greater than an 8-hour day, the time-weighted average (TWA) for that day must be reduced according to the formula:

- Allowable employee exposure (in  $\mu$ g/m<sup>3</sup>) = 400 divided by the hours worked that day.

## Potential Sources of Exposure

For WESTON operations, potential sources of exposure include, but are not limited to; industrial hygiene surveys, wet-process paint chip sampling, and drilling operations where lead is present as a contaminant.

In addition, certain "Trigger Tasks" such as; welding and cutting on lead paint or lead-contaminated structures, dry sanding or scraping, soldering and pipe-fitting operations involving lead-containing materials and dry cleanup of lead contaminated surfaces are potential exposure operations. Specific monitoring and protection requirements follow.

## Exposure Assessment and Initial Requirements

Each task conducted by WESTON personnel must be evaluated as to the potential for exposure to lead. In accordance with the standard, exposure is that which would occur regardless of the use of respiratory protection. Therefore, any concentration must be evaluated as to the potential for employee exposure at or above the AL.

## Hygiene Surveys and Sampling Tasks

Previous data less than 12 months old may be used as the initial exposure assessment in order to determine appropriate levels of protection. This data must have been collected under workplace and environmental conditions closely resembling current task activities.

Defensible data from previous soil sampling efforts may be utilized for determining preliminary levels of protection, by inserting soils concentration data into the action levels formula. Refer to the Corporate Environmental Health and Safety Portal Site under "Technical Resources" for guidance on calculating Action Levels. Personal air sampling must still be performed in order to verify exposure until and/or unless comprehensive background data (reviewed by an industrial hygienist) are available to justify omitting personal sampling.

Other objective data may be utilized in lieu of initial monitoring provided the objective data is documented and appropriate for the materials and work processes/activities conducted.

## Trigger Tasks

Until such time as an exposure assessment (either through personal air sample results or approved and documented historic data) has been conducted which indicates actual exposures, the following task-specific guidelines are applicable.

- Where lead-containing coatings or paint are present: Manual demolition of structures (e.g., dry wall), manual scraping, manual sanding, heat gun applications, and power tool cleaning with dust collection systems; and/or spray painting with lead paint. It will be presumed that the level of lead in the air is above the PEL but, below  $500 \mu\text{g}/\text{m}^3$ . The minimum respiratory protection for these activities is a properly fitted half-face respirator with N, R, or P100 filter cartridges. Respirators providing higher levels of protection may be used and an employee has the right to request a powered air-purifying respirator (PAPR) with N, R, or P100 Cartridges.
- Where activities involve using lead-containing mortar; lead burning where lead-containing coatings or paint are present: rivet busting; power tool cleaning without dust collection systems; cleanup activities where dry expendable abrasives are used; and abrasive blasting enclosure movement and removal, it will be presumed that the level of lead in the air is above the  $500 \mu\text{g}/\text{m}^3$  but below  $1250 \mu\text{g}/\text{m}^3$ . The minimum respiratory protection for these activities is a loose-

fitting hood or helmet PAPR with N, R, or P100 filter cartridges; a hood or helmet supplied air respirator operated in continuous flow mode (e.g. type CE abrasive blasting helmet operated in continuous flow mode). A Quantitative Fit Test is required for use of respiratory protection for these activities. Respirators providing higher levels of protection may be used. For WESTON personnel the minimum respiratory protection is a tight fitting full face respirator with N, R, or P100 filter cartridges unless an exception is approved by a WESTON Certified Industrial Hygienist.

**Note:** An employee has the right to request a PAPR with N, R, or P 100 Cartridges.

- Where activities involve: Abrasive blasting, welding, cutting, or torch burning, the respiratory protection required is any supplied air respirator operated in positive pressure mode.
- For any activity where it is reasonably believed that exposure over the PEL will result, the respiratory protection is: Half- or Full-Face air purifying respirator (APR) with appropriate high efficiency filters; PAPRs with appropriate cartridges; or Supplied Air Respirators. Actual selection is dependent upon the potential for exposure.

Until the employee exposure assessment (personnel monitoring or approved historic data) has been performed and actual employee exposure has been determined, all employees performing the tasks described in the paragraphs above in this section must be supplied with interim protection as follows:

- Appropriate respiratory protection.
- Appropriate personal protective clothing and equipment.
- Change areas.
- Hand washing facilities.
- Biological monitoring.
- Training.

## **Monitoring**

### **Initial Monitoring Requirements**

The exposure assessment results will be used to determine whether any employee is being exposed to lead at or above the action level of  $30\mu\text{g}/\text{m}^3$ .

With the exception of allowances described below, monitoring for worker exposure requires collection of personal air samples which are representative of a full shift for each task involving known or potential exposure and any of the following, relevant considerations:

- Any information, observations, or calculations which would indicate employee exposure to lead;
- Any previous measurements of airborne lead; and
- Any employee complaints of symptoms which may be attributable to exposure to lead.

**Note:** Monitoring for the initial determination, where performed, may be limited to a representative sample of the exposed employees who the employer reasonably believes are exposed to the greatest airborne concentrations of lead in the workplace.

## **Historical Data**

Where WESTON has previously monitored for lead exposures, such earlier monitoring results may be used to satisfy the requirements of initial monitoring and monitoring frequency, if the sampling and analytical methods meet the accuracy and confidence levels as indicated in paragraph of 29 CFR



1926.62(d)(9). Additionally, the data must have been obtained within the past 12 months during work operations conducted under workplace conditions closely resembling the processes, type of material, control methods, work practices, and environmental conditions used and prevailing in the current operations.

### **Objective Data**

Where objective data demonstrates that a particular product or material containing lead or a specific process, operation or activity involving lead cannot result in employee exposure to lead at or above the AL during processing, use, or handling, such data may be relied upon instead of performing initial monitoring.

An accurate record documenting the nature and relevancy of objective data used in assessing employee exposure in lieu of exposure monitoring, must be maintained.

**Exception:** Objective data, as described above, is not permitted to be used for exposure assessment in connection with the specific activities previously discussed as "Trigger Tasks".

### **Positive Initial Determination and Initial Monitoring**

Where a determination shows the possibility of any employee exposure at or above the AL, monitoring must be conducted which is representative of the exposure for each employee in the workplace who is exposed to lead.

### **Negative Initial Determination**

Where a determination is made that no employee is exposed to airborne concentrations of lead at or above the AL a written record of such determination must be made.

### **Frequency**

If the initial determination reveals employee exposure to be below the AL, further exposure determination need not be repeated except as otherwise provided in the last paragraph of this section.

If the initial determination or subsequent determination reveals employee exposure to be at or above the AL, but at or below the PEL monitoring must be conducted at least every 6 months.

If the initial determination reveals that employee exposure is above the PEL, monitoring must be performed quarterly.

Whenever there has been a change of equipment, process, control, or personnel or a new task has been initiated that may result in additional employees being exposed to lead at or above the AL or may result in employees already exposed at or above the AL being exposed above the PEL, additional monitoring must be conducted in accordance with this practice.

### **Employee Notification**

Each employee shall be notified in writing of the results which represent that employee's exposure within five working days after completion of the exposure assessment.

Whenever the results indicate that the representative employee exposure, without regard to respirators, is at or above the PEL a written notice is required stating that the employee's exposure was at or above that

level and includes a description of the corrective action taken or to be taken to reduce exposure to below that level.

Exposure monitoring records must be maintained as required in 29 CFR 1926.62(n)(1). Minimum information includes:

- Sampling data and procedures utilized.
- Description of sampling and analytical methods used.
- Type of respiratory protection used.
- Name, social security number, job classification for specific persons monitored and/or representative groups.
- Any environmental variables which could impact measurements.

### **Engineering Controls**

As in all cases of potential or known exposure to a hazardous environment, engineering controls are to be evaluated as to effectiveness and appropriateness under the site-specific circumstances. Controls must be listed in the site-specific Health and Safety Plan (HASP) and implemented as appropriate or feasible. Appropriate engineering controls include dust suppression, use of longer torches in cutting operations, use of mechanical shears in lieu of torches, vacuum blasting methods, and local ventilation.

### **Ventilation**

When mechanical ventilation is used to control lead exposure, the mechanical performance of the system must be evaluated and documented as to its effectiveness in controlling exposure.

### **Work Practice Controls**

WESTON will not use administrative controls such as worker rotation as a means of reducing employees' TWA exposure to lead unless expressly approved by a qualified safety professional.

### **General Housekeeping**

All surfaces shall be maintained as free as practicable of accumulations of lead.

Floors and other surfaces where lead accumulates shall, wherever possible, be cleaned by vacuuming or other methods that minimize the likelihood of lead becoming airborne.

Shoveling, dry or wet sweeping, and brushing may be used only where vacuuming or other equally effective methods have been tried and found ineffective.

Where vacuuming methods are selected, the vacuums shall be equipped with HEPA filters and used and emptied in a manner which minimizes the reentry of lead into the workplace.

Compressed air shall not be used to remove lead from any surface unless the compressed air is used in conjunction with a ventilation system designed to capture the airborne dust created by the compressed air.

## **Hygiene Facilities and Practices**

In control zone areas where employees are exposed to lead above the PEL without regard to the use of respirators, food or beverage shall not be present or consumed, tobacco products shall not be present or used, and cosmetics shall not be applied.

Clean change areas shall be provided for employees whose airborne exposure to lead is above the PEL, without regard to the use of respirators.

To prevent cross-contamination, change areas, as needed, shall be equipped with separate storage facilities for protective work clothing and equipment and for street clothes.

Employees exposed to lead concentrations greater than the AL shall not leave the workplace wearing any protective clothing or equipment that is required to be worn during the work shift.

Shower facilities shall be provided, where feasible, for use by employees whose airborne exposure to lead is above the PEL. Adequate supplies, cleansing agents, and towels shall be provided.

Lunchroom facilities or eating areas shall be as free as practicable from lead contamination and readily accessible to employees.

Employees whose airborne exposure to lead is above the PEL, without regard to the use of a respirator, must wash their hands and face prior to eating, drinking, smoking or applying cosmetics.

Employees shall not enter lunchroom facilities or eating areas with protective work clothing or equipment which has been contaminated by surface lead dust in concentrations exceeding the AL.

Adequate hand washing facilities shall be provided for use by employees exposed to lead in concentrations exceeding the AL. These facilities must be designed in accordance with 29 CFR 1926.51(f). Where showers are not provided, employees must wash their hands and face at the end of the work-shift.

**Note:** Short-term (less than one week) field activities may utilize appropriate personal decontamination sequences such as those allowed under 29 CFR 1910.120 (HAZWOPER) in lieu of contained clean rooms, showers and change facilities.

## **Personal Protective Clothing and Equipment**

Where exposures to lead above the AL (without regard to the use of respirators) have been validated by monitoring or where employees are exposed to lead compounds which may cause skin or eye irritation (e.g. lead arsenate, lead azide), and as interim protection for employees performing tasks as specified as “Trigger Tasks”, affected employees must use appropriate protective work clothing and equipment that prevents contamination of the employee and the employee's garments such as, but not limited to:

- Coveralls or similar full-body work clothing;
- Gloves, hats, and shoes or disposable shoe coverlets; and
- Face shields, vented goggles, or other appropriate protective equipment as necessary.
- Change areas in accordance with 29 CFR 1926.62(i)(2).
- Hand washing facilities in accordance with 29 CFR 1926.62(i)(5).

- Biological monitoring in accordance with 29 CFR 1926.62(j)(1)(i), to consist of blood sampling and analysis for lead and zinc protoporphyrin levels, and;
- Training as required under 29 CFR 1926.62(l)(1)(i) regarding 29 CFR 1926.59, Hazard Communication; training as required under 29 CFR 1926.62(l)(2)(ii)(C), regarding use of respirators; and training in accordance with 29 CFR 1926.21, Safety training and education.

The HASPs and fixed facility operating procedures must list specific and appropriate PPE that will be utilized for each task involving known or potential exposure to lead or lead compounds.

PPE utilized will be disposable garments. Personnel in maintenance or fixed operations may use re-useable garments only under the direction and approval of a qualified safety professional.

Garments will be disposed of at the end of a shift or upon leaving a controlled zone whichever comes first. Under no conditions will any employee be allowed to take contaminated garments with the employee to his or her home.

Proper decontamination of re-usable equipment/PPE must be conducted prior to allowing these materials to leave the site.

Contaminated protective clothing which is to be cleaned, laundered, or disposed of, must be placed in a closed container in the change area which prevents dispersion of lead outside the container.

Containers of contaminated (defined as when exposures are greater than or equal to the PEL) protective clothing and equipment must be labeled as follows:

"Caution: Clothing contaminated with lead. Do not remove dust by blowing or shaking. Dispose of lead contaminated wash water in accordance with applicable local, state, or federal regulations."

The removal of lead from protective clothing or equipment by blowing, shaking, or any other means which disperses lead into the air shall be prohibited.

## **Respirators**

For WESTON operations, respirators shall be used in accordance with WESTON's Respiratory Protection Program in the following circumstances:

- Whenever an employee's exposure to lead exceeds the AL;
- In work situations in which engineering controls and work practices are not sufficient to reduce exposures to or below the AL;
- Whenever an employee requests a respirator; and
- As interim protection for employees performing "Trigger-tasks".

Respirators approved for use are limited to:

- Properly fitted half-face APRs with high-efficiency filters for concentrations not exceeding 500µg/m<sup>3</sup>.

- A loose fitting hood or helmet PAPR with N, R, or P100 filter cartridges; a hood or helmet supplied air respirator operated in continuous flow mode (e.g. type CE abrasive blasting helmet operated in continuous flow mode for concentrations not to exceed 1250  $\mu\text{g}/\text{m}^3$ ).
- Properly fitted full-face APRs with high efficiency filters for concentrations not in excess of 2,500  $\mu\text{g}/\text{m}^3$ .
- Tight fitting full-facepiece PAPRs with high-efficiency filters for concentrations not in excess of 2,500  $\mu\text{g}/\text{m}^3$ .
- Full-facepiece, positive-pressure supplied air respirators (SARs) for concentrations not in excess of 100,000  $\mu\text{g}/\text{m}^3$ .
- Full-facepiece self-contained breathing apparatus (SCBA) for concentrations greater than 100,000  $\mu\text{g}/\text{m}^3$  or for unknown concentrations.

Respirators specified for higher concentrations can be used at lower concentrations of lead.

A full facepiece is required if the lead aerosols cause eye or skin irritation at the use concentrations.

Fit-testing must be conducted in accordance with WESTON's Respiratory Protection Program and 29 CFR 1910.134.

### **Signs and Labels**

The following warning signs shall be posted in each work area where exposure to lead is above the PEL.

WARNING

LEAD WORK AREA

POISON

NO SMOKING OR EATING

Signs required by this paragraph must be illuminated and cleaned as necessary so that the legend is readily visible from all areas of approach to the work area.

### **Medical Surveillance**

Initial medical surveillance in the form of blood testing shall be made available to employees occupationally exposed on any day to lead at or above the AL.

Biological monitoring in the form of blood sampling and analysis for lead and zinc protoporphyrin levels will be performed during initial medical surveillance and must be performed on the following schedule:

- For any employee anticipating work at a site or operation where the known or potential exposure (without regard to the use of respiratory equipment) equals or exceeds the AL, biological monitoring must be conducted prior to the start of that person's work on site or within 48 hours of such determination. Post-site work monitoring must be conducted within one week of that person's completion of site work. NOTE: This initial determination and need for blood testing should be reviewed by a Certified Industrial Hygienist; particularly if a negative determination is made. Appropriate documentation must be placed in the site files for future reference.

- During long-term (greater than 30 days) site activities for each employee with known or potential exposure to or greater than the AL for 30 or more days per year, at least every 2 months for the first 6 months and every 6 months thereafter.

Within 5 working days after the receipt of biological monitoring results, WESTON's medical consultant will notify each employee in writing of his or her blood lead level. The content of and review mechanisms for medical examinations made available shall be pursuant to 29 CFR 1926.62(j).

For any employee found to have a blood lead level at or above 40µg/100g of whole blood, testing will be performed every 2 months until two consecutive blood samples and analysis indicate a blood lead level below 40µg/100g of whole blood.

### **Medical Removal and Protection**

WESTON will temporarily remove an employee from work having an exposure to lead at or above the AL on each occasion that a periodic and a follow-up blood sampling test conducted pursuant to 29 CFR 1926.62(k) indicate that the employee's blood lead level is at or above 50 µg/dl.

WESTON will remove an employee from work having an exposure to lead at or above the AL on each occasion that a final medical determination results in a medical finding, determination, or opinion that the employee has a detected medical condition which places the employee at increased risk of material impairment to health from exposure to lead.

**Note:** Medical removal protections shall be strictly as interpreted under 29 CFR 1926.62(k) and other applicable Acts or Standards.

In the event any employee must be removed from work activities due to blood lead levels records and documents must be maintained in the project files as required in 29 CFR 1910.1025(n) or 1926.62(n).

### **Education and Training**

All WESTON personnel with potential occupational exposure to lead will be provided with training, initially and annually thereafter, as to:

- Content of the standards 29 CFR 1910.1025 and 1926.62.
- The nature of operations which could result in exposure at or above the action level on any one day.
- Respirator use, selection and maintenance.
- Medical surveillance and medical removal requirements and protections.
- Health effects of lead.
- Engineering and work practice controls.
- WESTON's Lead Exposure Compliance Program and associated site specific plans.

### **Recordkeeping and Training**

Documentation of training records in the form of training materials and attendance sheets will be maintained in the project files.

## **Exposure Assessments**

Monitoring and data sheets used to determine employee exposures must be maintained on all sites with lead exposure. As required under 29 CFR 1910.20, copies of all documentation must be maintained in the project files.

Exposure assessment and monitoring records must include:

- The date(s), number, location and results of samples taken.
- The determination that the sampling procedures are representative of employee exposure.
- A description of the sampling and analytical procedures used.
- The type of respiratory protection used, if any.
- The name, employee number, and job classification of the employee(s) monitored.
- Environmental conditions encountered.

Objective data which is or will be used for determining exemption from initial monitoring as allowed under 29 CFR 1926.62(d)(3) must be maintained in the project files. Objective data utilized is required to be maintained for a period of at least 30 years.

## **Medical Surveillance**

Medical surveillance will be conducted and records will be maintained in accordance with WESTON's Occupational Medical Monitoring Program requirements as indicated in 29 CFR 1910.1025(n) and/or 1026.62(n).

## **Task Specific Methods of Control**

Based upon WESTON policy, each site activity involving potential exposure to lead must be identified and analyzed through a Task/Risk Analysis as a part of the site-specific HASP. This Task/Risk Analysis must identify methods, materials and equipment utilized in limiting exposure. Appendix 1 provides Actions/Requirements Based on Task. Appendix 2 provides a Task/Risk Analysis Inspection Checklist.

Current HASP forms can be obtained through the Division Environmental Health and Safety Manager, Corporate Environmental Health and Safety or on the WESTON EHS Portal Site.

## **Hazard Communication and Multi-Employer Sites**

On multi-employer sites where the activities of one contractor/employer will or may have a direct impact with potential exposure to other contractors/employers, the Site Manager is responsible for contacting a representative of the potentially affected parties. The Site Manager will inform them of the lead exposure potential, control methods utilized, protective procedures to be followed, and the limits of lead contamination as known.

## **Inspections and Audits**

The Project Manager is responsible for providing (at a minimum) weekly documented inspections of the work site. In accordance with the requirements of the lead standard these inspections must encompass all areas of the site where exposure to lead is at or above the PEL (Appendix 2). Additionally, any equipment, PPE, signs, and decontamination or disposal operations must be evaluated as to compliance with the standard and WESTON Policy regardless of the exposure concentration. Any non-compliance must be noted and corrected.

## **APPENDIX 1**

### **ACTIONS/REQUIREMENTS BASED UPON TASK:**

**1. Exposure Less than Action Level (AL):**

- Initial Exposure Assessment
- Hand Washing Facilities
- Proper Housekeeping
- Medical Removal Protection

**2. Exposure at or over AL but less than Permissible Exposure Limit (PEL):**

- Initial Exposure Assessment
- Hand Washing Facilities
- Periodic Exposure Monitoring
- Biological Monitoring and Recordkeeping
- Annual Training
- Proper Housekeeping
- Medical Removal Protection

**3. Exposure at or over AL but less than the PEL (30 or more days/year):**

- As above and
- Medical Examinations and Recordkeeping

**4. Exposure at or greater than the PEL:**

- Initial Exposure Assessment
- Hand Washing Facilities
- Periodic Exposure Monitoring
- Biological Monitoring and Recordkeeping
- Annual Training
- Proper Housekeeping
- Appropriate Respiratory Protection
- Warning Signs
- Proper PPE
- Proper Change Areas
- Decontamination Facilities/Showers as feasible
- Separate Eating Areas
- Medical Examinations and Recordkeeping
- Medical Removal Protection

**5. Exposure to Trigger Tasks (until exposure is verified):**

- See requirements under greater than PEL exposure



**APPENDIX 2**  
**TASK/RISK ANALYSIS AND INSPECTION CHECKLIST**  
**FOR ACTIVITIES WITH POTENTIAL FOR LEAD EXPOSURE**

This task involves the known or potential risk of exposure to lead or lead-containing materials. As such, requirements as indicated in 29 CFR 1910.1025 or 29 CFR 1926.62 and WESTON's Written Lead Exposure Compliance Program (FLD 46) will be followed.

**Task Description:**


**Equipment Required/Used:**


**Training Required/Used:**


**Initial Exposure Determination: (Indicate Method[s] Used)**

	Personal Sampling
	Objective Data (attach or indicate location of data)
	Historical Data (attach or indicate location of data)

**PPE Includes:**

	Respiratory Protection (specify)		Shoes or Shoe Covers (specify)
	Coveralls (disposable)		Face Shield, Goggles or Safety Glasses (specify)
	Coveralls (reusable)		Other (specify)
	Gloves (specify)		
	Head Covering (specify)		

**Inspection Items:**

Y/N	Item/Action
	Personnel are wearing appropriate PPE.
	PPE is in good condition.
	PPE is removed and disposed of in a manner to preclude airborne release of lead or lead compounds.
	Will clothing be laundered?
	If yes, then ensure notification of vendor as required.
	Will clothing be disposed of?
	If yes, container of disposable clothing and contaminated materials is closed and appropriately labeled.
	All surfaces are maintained (as practicable) free of lead or lead compounds.
	Appropriate methods and procedures are used for cleanup of surfaces with lead contamination.
	If vacuum is utilized, it is equipped with appropriate HEPA filter.
	If exposure is known or suspect to be at or greater than the PEL, then:
	There is no eating, drinking, cosmetic application, or tobacco consumption in contaminated areas.
	Change areas are available.
	Change areas are maintained to prevent cross-contamination of work and street clothing.
	No work clothing which has been known or is potentially contaminated is allowed to be worn off-site or in on-site clean areas.
	Clean, sanitary showers (where feasible) are maintained.
	All personnel shower prior to leaving the site at end of shift.
	Clean, sanitary eating areas are provided.
	Hand washing facilities are provided in all cases.
	Personnel are required to wash hands and face upon leaving the contaminated area.

**Comments:**

## **FLD 49 SAFE STORAGE OF SAMPLES**

### **REFERENCE**

DOT Emergency Response Guide (ERG)

To ensure that multi-media samples collected in the course of WESTON work assignments are not stored in a manner that creates undue hazard to WESTON employees or others.

### **PROCEDURE**

Samples that are transported from a WESTON work location must be classified and packaged in compliance with U.S. Department of Transportation (DOT) regulations or alternatively in accordance with International Air Transport Association (IATA) regulations. WESTON's manual of Procedures for Shipping and Transporting Dangerous Goods must be consulted to determine if the samples will be classified as either "environmental" or "hazardous materials" samples.

#### **Environmental Samples**

Environmental samples are not subject to DOT or IATA dangerous goods regulations and must be packaged to protect their integrity during transportation and temporary storage and should have appropriate chain-of-custody documentation. These samples may be brought to a WESTON office location or rented space to verify sample documentation and repackaging (e.g., with ice or cold packs). Minor spill clean-up capability is required.

Once secured for shipment, these samples can be temporarily stored for the next day ground or air shipment pick-up. Under no circumstances are samples to be stored beyond the time necessary to arrange for transportation to a laboratory.

#### **Hazardous Materials Samples**

These samples are subject to DOT and/or IATA dangerous goods regulations and must be packaged and labeled according to the appropriate regulations, including completed chain-of-custody documentation prior to being transported from the WESTON work site. WESTON drivers must have the documentation for the samples and a DOT Emergency Response Guide (ERG) readily available in the vehicle. The ERG is available on-line at: <http://hazmat.dot.gov/pubs/erg/gydebook.htm> and appropriate sections can be copied to accompany samples being transported by vehicles driven by WESTON employees.

Under normal circumstances these samples should be shipped from the field and never brought back to a WESTON office location or into a rented space. If it is not possible to ship the samples from the field during the same day they are collected, a properly packaged, labeled, and sealed sample shipping container may be brought back to a WESTON office location for shipment to a laboratory the next business day - provided the temporary storage location is secure from access by any personnel who are not trained in shipping hazardous materials. Under no circumstances are samples to be stored in rented space; if necessary, secure temporary storage in a locked vehicle may be authorized. Note that some office leases do not permit the storage of hazardous materials and the lease will govern whether such materials can be stored overnight.

## **INSPECTION FOLLOW-UP**

Shipping procedures for samples should be included in the site-specific health and safety plan (HASP) and reviewed for compliance with these procedures prior to approval. EHS audits will include a review to sample shipping and storage procedures.